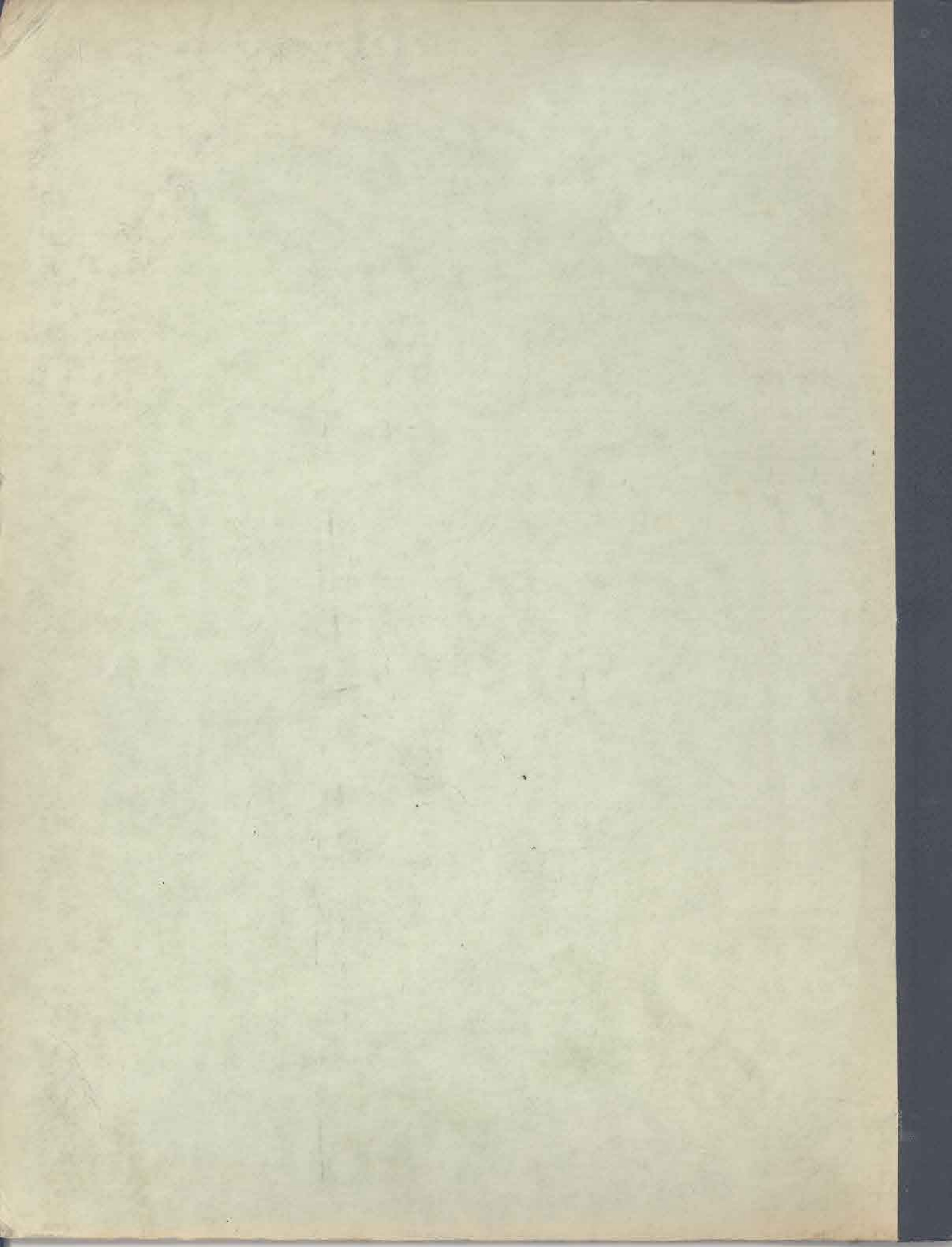


**PYROTECHNICS  
AND  
MISCELLANEOUS EXPLOSIVE ITEMS**



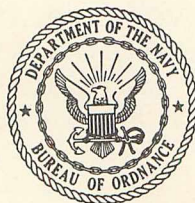
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**A BUREAU OF ORDNANCE PUBLICATION**





**PYROTECHNICS  
AND  
MISCELLANEOUS EXPLOSIVE ITEMS**



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**31 DECEMBER 1957**



DEPARTMENT OF THE NAVY  
BUREAU OF ORDNANCE  
WASHINGTON 25, D. C.

31 December 1957

ORDNANCE PAMPHLET 2213

PYROTECHNICS AND MISCELLANEOUS EXPLOSIVE ITEMS

1. Ordnance Pamphlet 2213 describes pyrotechnic items and miscellaneous explosive items used by aircraft personnel and by personnel aboard surface and subsurface vessels. General and specific data are given for each item, including descriptions of components, where items are applicable, and their use.
2. When new items of the types covered by this publication are authorized for use by the naval establishment, changes to this publication will be issued. Similarly, as items are removed from service use, changes will be promulgated to effect removal of the applicable sections of this publication.
3. This publication supersedes the following publications which should be destroyed:

OP 998	NAVORD OCL AV7-48	NAVORDINST 8052.1
OP 1177	NAVORD OCL AV3-50	NAVORDINST 8053.1
OP 1492	NAVORD OCL AV1-52	NAVORDINST 8190.1
NAVORD OML AV1-51	NAVORD OHI A9-45	NAVORDINST 8190.2

F. S. WITHINGTON

A handwritten signature in dark ink, reading "F. S. Withington", is positioned below the printed name.

Rear Admiral, U. S. Navy  
Chief, Bureau of Ordnance



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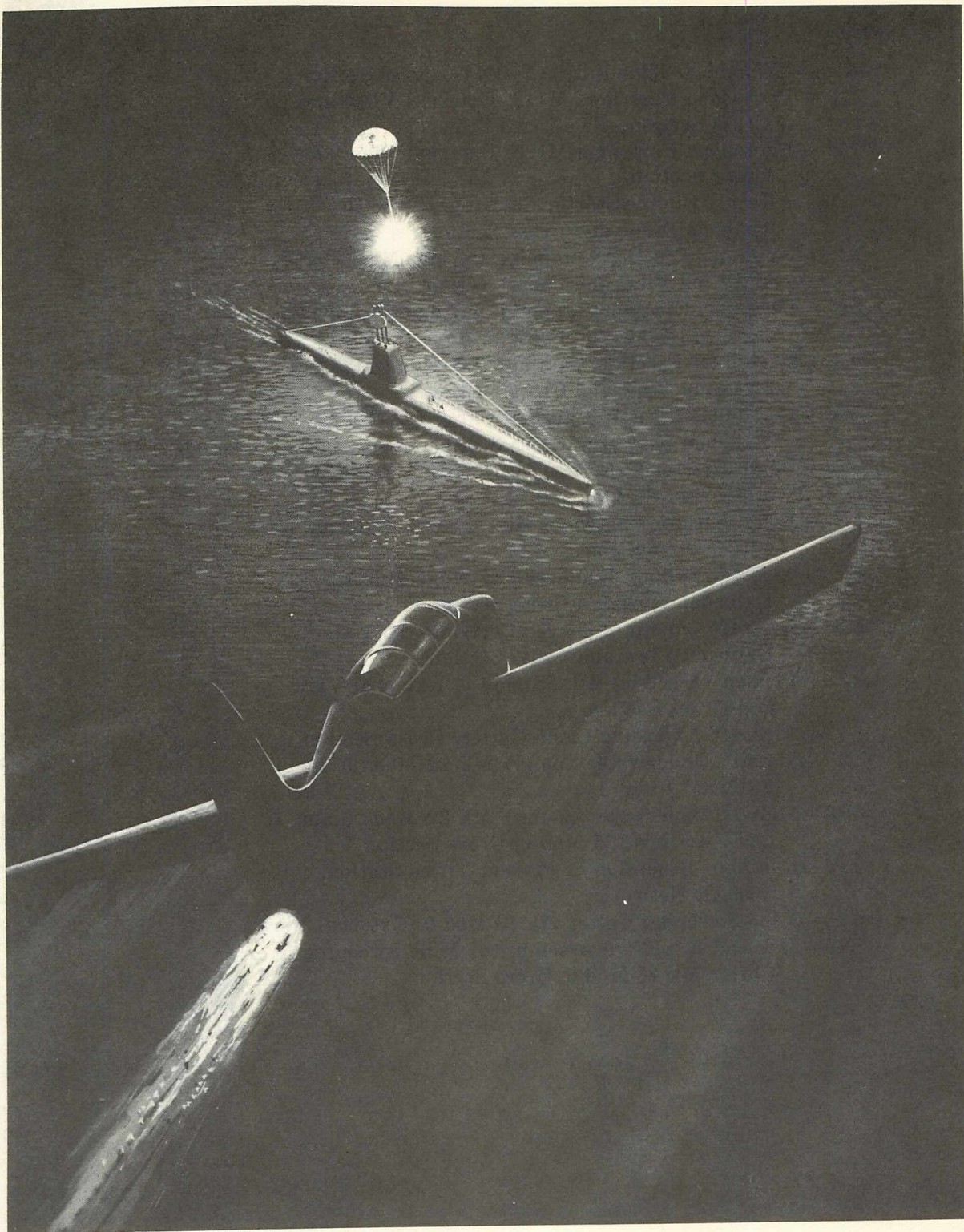


Figure 1.1—Aircraft Parachute Flare in Night Submarine Warfare.



## Chapter 1

### FLARES

#### Introduction

Flares are pyrotechnic items used to provide illumination, as signals for identification or emergency use, and in rescue work. They may be grouped in two general classes—those designed for launching from aircraft, and those designed for launching from surface vessels or shore installations.

Aircraft flares are used to illuminate large areas for the purpose of bombardment, reconnaissance, emergency landing of aircraft, or any other purpose where a light of high intensity is required for a duration of several minutes. The light produced by these flares can be used to temporarily blind operators of anti-aircraft weapons.

Surface flares are launched or fired from surface vessels or from shore installations for the purpose of illuminating specific areas. Some flares float in the water and are used to silhouette enemy ships. Others are projected into the air and are parachute suspended for the purpose of lighting specific areas. Smaller parachute flares are used on land as part of booby trap installations to warn against marauders. Flares are also used for signaling and for rescue work.

**Aircraft Flares.** Aircraft flares are divided into two main groups. The first group includes flares that fall a predetermined distance, which may be several thousand feet, before functioning. The second group includes flares that begin to function at a distance of only 30 to 50 feet below the launching aircraft.

**DELAY-TYPE FLARES.** Delay-type flares are those which drop for some distance before being ignited by a delay fuze. The drop may be a free fall until the delay fuze operates to discharge the parachute and ignite the flare as with the Flares Mk 5 and Mk 6, or it may be parachute-suspended as with the

Mk 8. In the Mk 8, the parachute opens 30 to 50 feet from the aircraft and suspends the unopened parachute tube until the preset delay fuze ejects the parachute and ignites the flare. Both types of flares are described below. The operation of the Mk 5 Flare is illustrated in figure 1.2.

**IMMEDIATE - FUNCTIONING - TYPE FLARES.** The operation of the immediate-functioning-type flare is illustrated in figure 1.3. The length of ripcord necessary to allow the flare to drop below the launching aircraft before it begins to function is contained on a wood reel at the parachute end. The ripcord tears along the case to the ripcord spool. It unwinds from the spool, tears away the end of the case, and pulls the parachute tube out of the case. When the parachute, shroud cords, and suspension cable become taut, the release-key cord pulls the release-key and allows the ripcord to become detached.

Just before the suspension cable becomes taut, the ignition wire pulls four friction wires. This action ignites a length of quick-match or, in some flares, a length of delay fuse. This, in turn, ignites a firecracker fuze and more quickmatch stapled to the firstfire composition of the pyrotechnical candle.

Aircraft parachute flares should not be launched manually except in extreme emergencies. Ripcords or parachutes of manually launched flares may become fouled on the tail surfaces of the aircraft. Flares must be stowed securely because loose flares in the cockpit of an aircraft may foul the controls or become ignited, especially if the aircraft is catapulted. Support bands are not used in manual launching, and an extra 10 feet of ripcord must be provided to secure the flare ripcord to some substantial part of the aircraft structure. If a delay fuze is present,



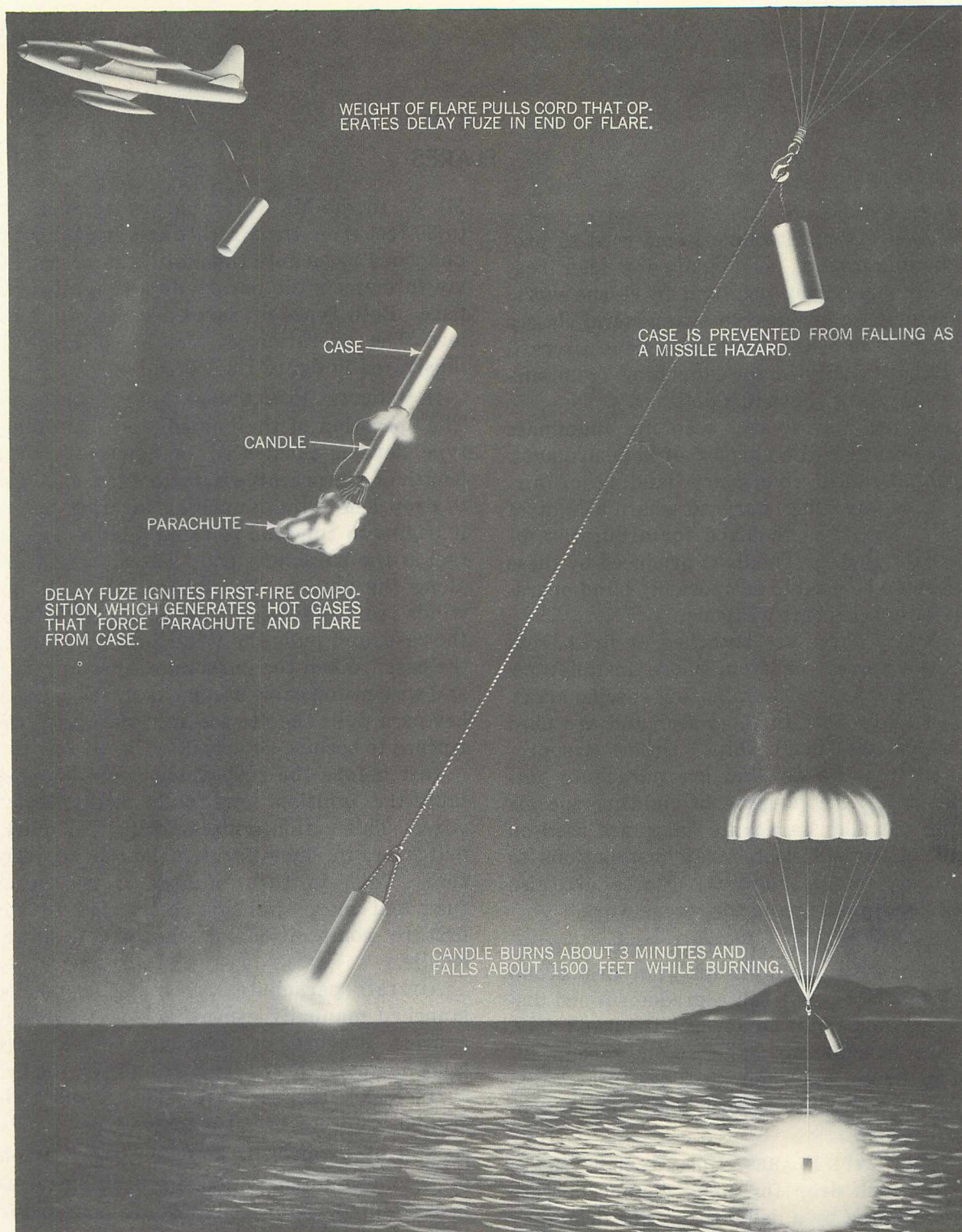


Figure 1.2—Operation of Delay-Type Flare.



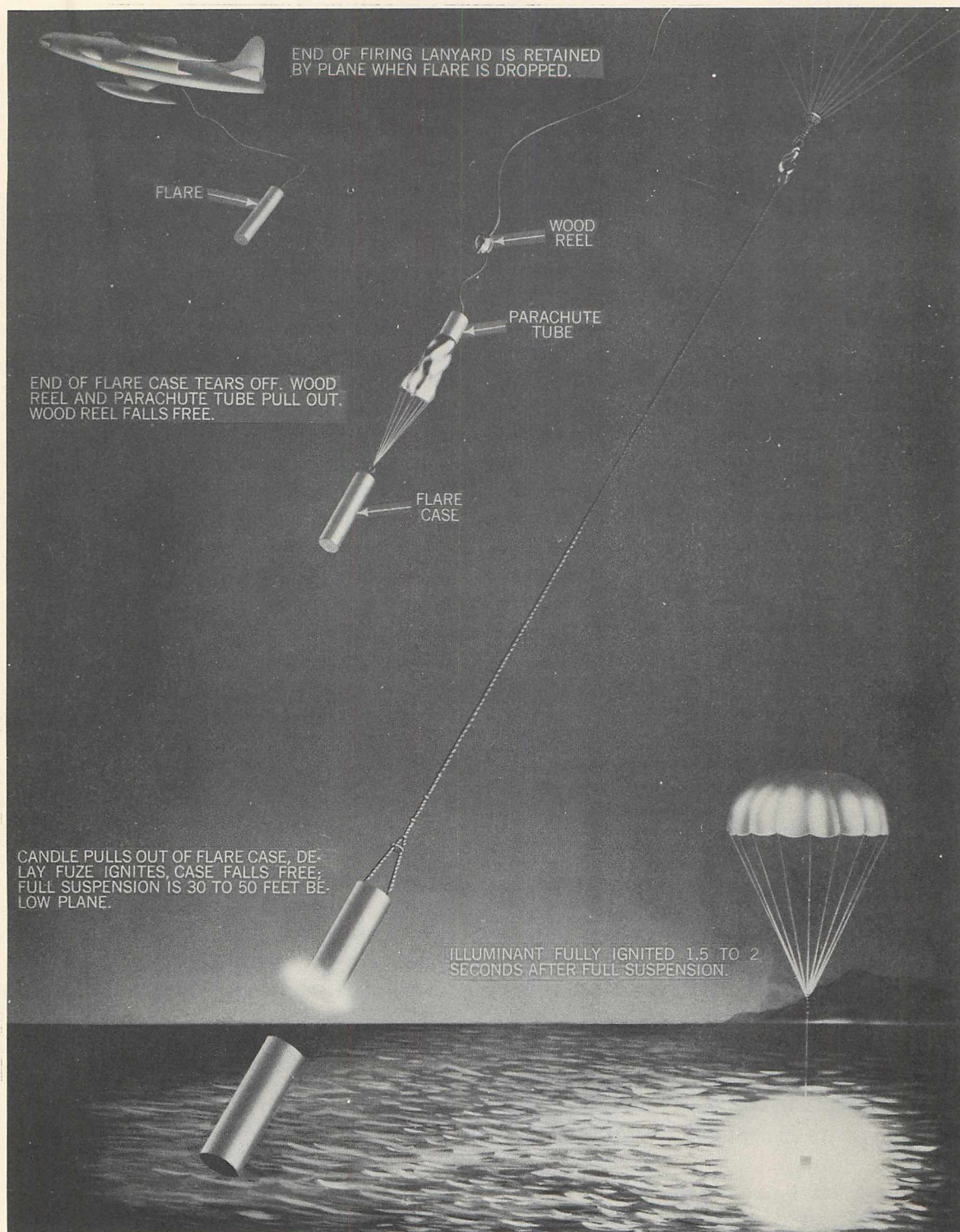


Figure 1.3—Operation of Immediate-Functioning-Type Flare.



it must be set for the desired delay as described. The flare is then launched with as much downward velocity as possible so that it will clear the after-structure of the aircraft. The flares are marked to indicate which end must be up (or forward) when launched.

**MARKING AND IDENTIFICATION.** Aircraft flares are marked to show the location of suspension bands, and how the flare is to be oriented for launching. Mark, mod, nomenclature, lot, manufacturer, and year of manufacture are also included.

**HANDLING AND STOWAGE.** Aircraft Flares are dangerous to handle because they are easily actuated. Flares that have been exposed to excessive moisture or otherwise damaged must be returned to ammunition depots or disposed of according to current instructions. Flares must not be disassembled.

Flares that have been installed but not launched should be removed from aircraft when there is no reason to anticipate their early use. When removing flares from aircraft, ripcords must be securely taped back in place, fuzes set on SAFE, and safety screw, where required, reinstalled. The flares must then be returned to original containers and sealed with paraffin. Support bands and accessories should be packed with the flares when they are returned to stock or ammunition depots.

Aircraft flares must be stowed in a dry place out of the direct rays of the sun. The temperature in the stowage space should never exceed 100° F. The primers contain fulminate of mercury, which deteriorates rapidly under high temperature conditions. At all times, pyrotechnic flares must be kept clean and free of foreign substances. Flares should be stowed in their moistureproof shipping containers when not installed on an aircraft.

Defective flares may be disposed of in accordance with OP 5, or as otherwise directed.

**GENERAL SAFETY PRECAUTIONS.** Do not smoke or carry lighted cigars, cigarettes, or pipes in the vicinity of aircraft flares.

Do not carry matches or spark-producing

materials in or near stowage, or while handling or using aircraft flares.

All flares aboard an aircraft must be securely fastened because a loose flare is a source of danger, both of mechanical damage to the aircraft and of fire.

**Surface Flares.** Surface flares are launched in several different ways. Flares that float are launched by hand from surface vessels. Parachute flares are fired from booby-trap devices upon actuation of a pull wire. Mortars are also used to fire the larger parachute flares needed to illuminate wide areas.

This pamphlet includes a number of light-producing pyrotechnics that, although not covered in this chapter, should be considered along with flares. See the chapter on "Signals" for items that have flarelike qualities but are used primarily for communication.

**MARKING.** Flares are marked with nomenclature, mark, mod, lot, manufacturer, and date of manufacture.

**HANDLING AND STOWAGE.** Flares should be handled carefully. Rough handling may cause immediate functioning of the item, or may damage it so that it will not function properly at the time desired.

Flares should not be stowed where the direct rays of the sun can strike them. They should be protected against excessive and variable temperatures. The temperature in stowage spaces should be below 100° F. This temperature limitation is imposed because many pyrotechnic items incorporate commercial impact-type primers containing fulminate of mercury, which deteriorates rapidly when stowage temperatures exceed 100° F.

**GENERAL SAFETY PRECAUTIONS.** Smoking or carrying lighted cigars, cigarettes, or pipes is not permitted in the vicinity of flares. Matches and other flame or spark-producing articles should not be carried near places where flares are stowed.

Flares are more dangerous as a fire hazard than many types of ammunition because they are easily activated. Extreme care is therefore necessary in stowage and use.



Flares should never be disassembled nor parachutes or other components removed. Inert flares are available for instructional purposes.

The different mods of this flare indicate different manufacturers.

**Operation.** When the flare is dropped, one end of the ripcord is retained by the

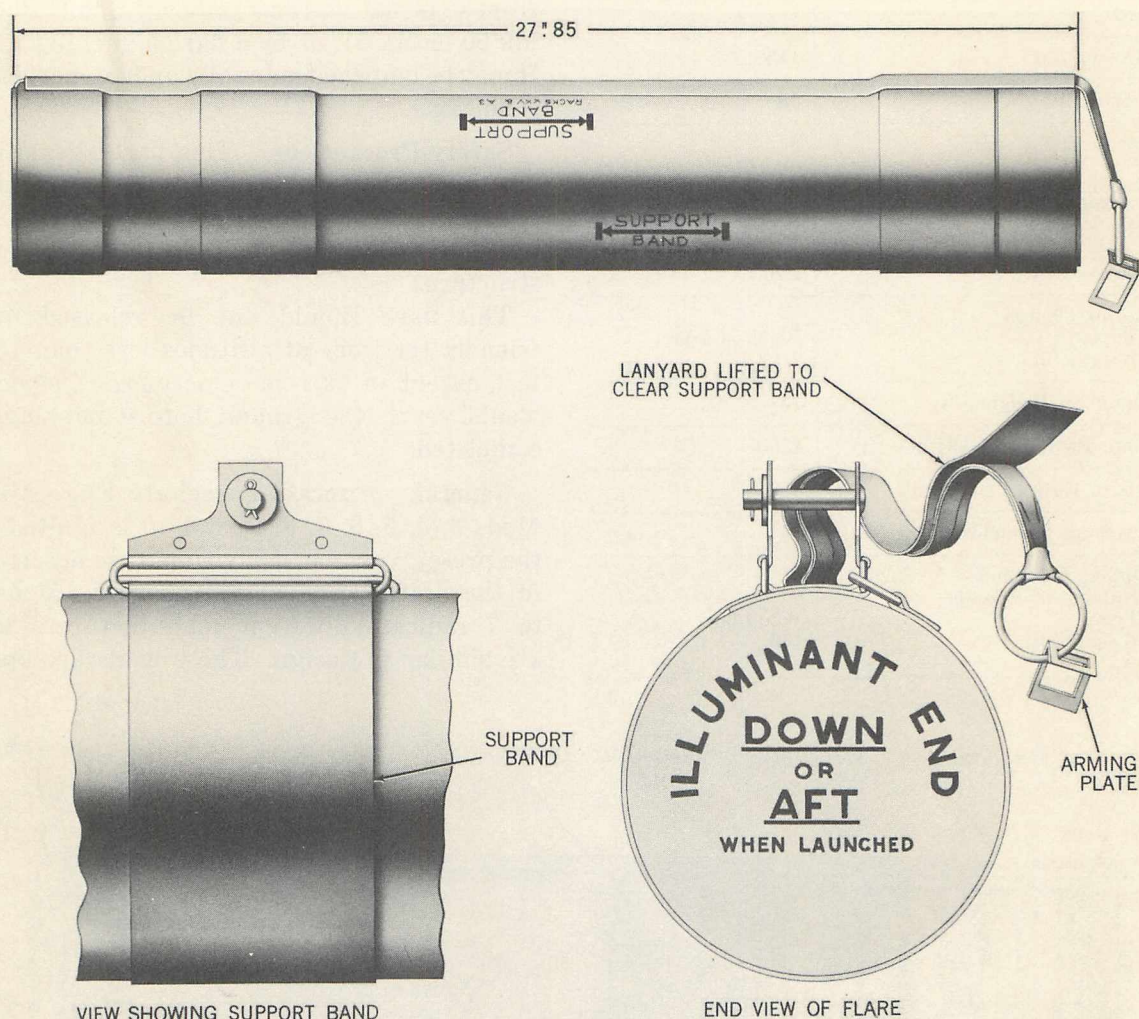


Figure 1.4—Aircraft Parachute Flare Mk 4 Mod 5, External View.

**General.** Aircraft Parachute Flare Mk 4 Mods 2, 3, 4, and 5 is of the type ignited 30 to 50 feet below the launching aircraft.

This flare is used primarily to illuminate an area to permit the landing of aircraft. It is used also for reconnoitering, bombing, and blinding antiaircraft defenses.

The flare has two metal steadying bands against which the steadying forks of the bomb rack rest. The complete flare is issued in a waterproof metal container.

plane. The ripcord unwinds from around the wood reel in the flare case. The end disc and reel fall away and the flare case is retained by the ripcord. The parachute is pulled out of its tube by the weight of the illuminant and the flare case. When the parachute and its shrouds are fully extended, the release-key cord pulls the release key down, allowing the ripcord to slip through the key, and the flare falls free.

An ignition wire attached to the suspension



### Aircraft Parachute Flare Mk 4 Mods 2, 3, 4, and 5

Mk	4
Mod	2, 3, 4, 5
Drawing No.	115019
Weight (lb)	18
Burning Time (min)	3
Candlepower	300,000
Color	White
Delay (sec)	1 to 2
Ignition Charge Type Weight (oz)	Black powder 7.07
Illuminant Weight (lb)	13
Minimum Release Altitude (ft)	1500
Rate of Descent (ft/min)	350
Parachute Diameter (ft)	15
Shipping Container Number of Rounds Type Weight (lb)	6 Wood box 170

and illuminant. When the parachute opens, the illuminant is pulled out of the flare case and the flare case falls free.

**Launching.** This flare may be released from external stations only by Bomb Racks Mk 50 or Mk 51, or by a flare-launching tube. It may be launched manually under emergency conditions.

**Safety Precautions.** This flare should not be launched from bomb bays because the parachute is pulled out of the flare case by the static line and may foul the airplane structure.

This flare should not be released over friendly territory at altitudes less than 1500 feet except in extreme emergencies, since it would reach the ground before burning is completed.

**General.** Aircraft Parachute Flare Mk 5 Mods 3, 4, 5, 6, 7, 8, 9, and 10 is ignited by the preset, variable delay time fuze described in the first section of the chapter. Mods 3 to 7 indicate different manufacturers and are similar in design. These mods are oper-

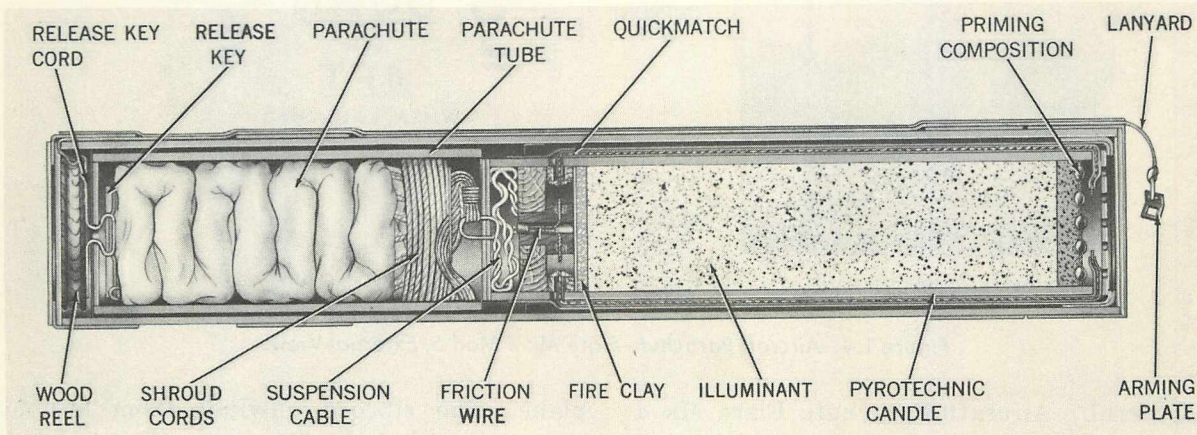


Figure 1-5—Aircraft Parachute Flare Mk 4 Mod 5, Cross Section.

cable is pulled before the cable is fully extended. Four friction wires attached to the ignition wire run through primer cups of match compound. This ignites a quickmatch train which burns down the outside of the illuminant case and ignites the primer composition; this, in turn, ignites the first fire

ated by a snap cord which must break before the firing lever is released to strike the primer. This requires a pull of about 38 pounds. Later mods have a modified fuze that requires only an 8-pound pull to operate the firing lever. The cord pulls away instead of breaking.



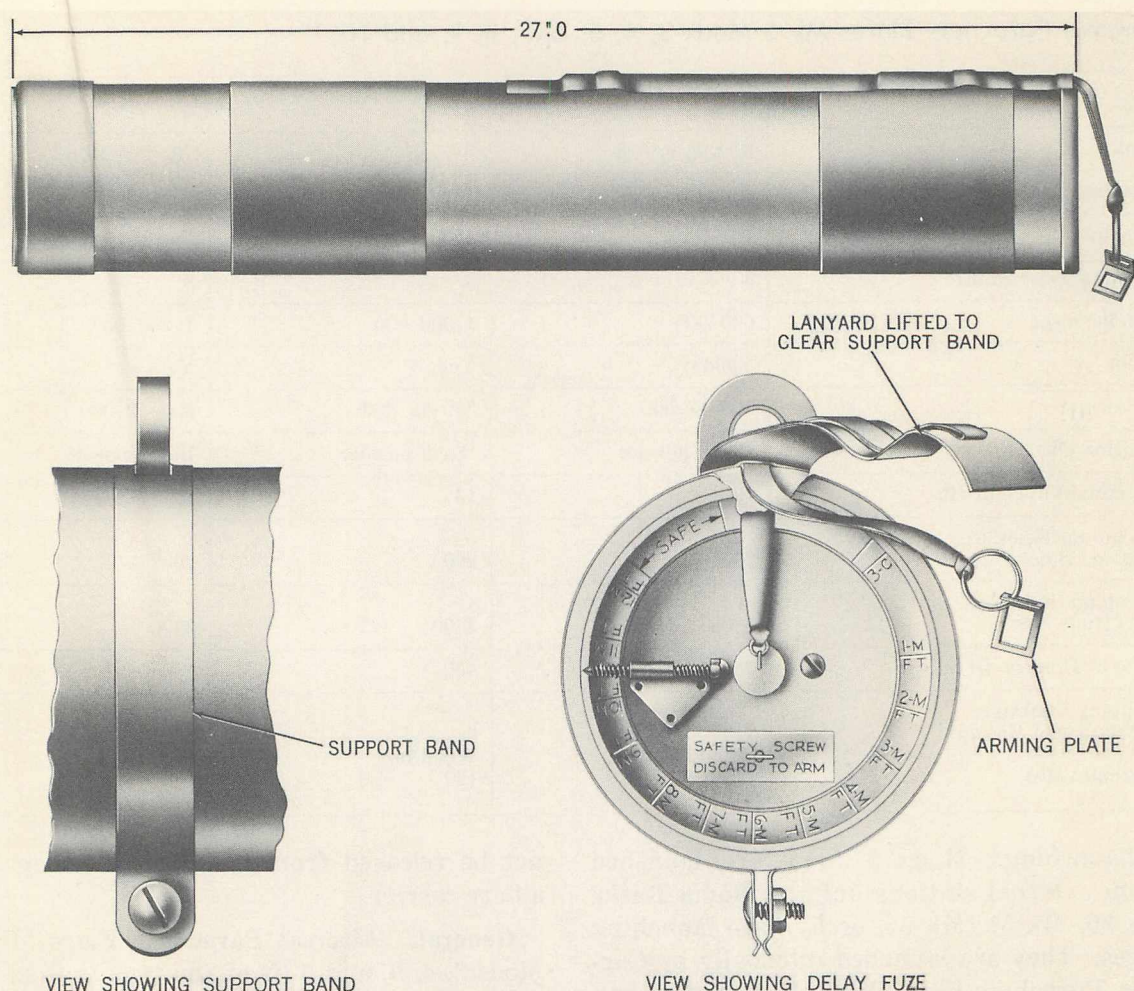


Figure 1.6—Aircraft Parachute Flare Mk 5 Mod 10, External View.

**Operation.** These flares operate as follows. The delay fuze ignites the quickmatch under the fuze block. This, in turn, ignites the quickmatch and firecracker fuse stapled to the ignition (first-fire) composition. The resulting gases force the parachute and illuminant from the case. The parachute tube, which is of split construction, falls away. In Mods 3 to 7, a retention cable slides through the trigger snap on the end of the shroud lines until it reaches a cable stop. A short length of cable on one side of the cable stop suspends the flare case, and a longer length suspends the illuminant. This keeps the case from dropping as a missile hazard. In later mods, the flare case is not secured to the

retention cable and the flare case falls free.

In Mods 3 to 8, the shock of the opening parachute is partially absorbed by a snubber device, consisting of lead balls on a suspension cable, which is pulled through a hole smaller in diameter than the balls. Some lead is sheared off as each ball is pulled through the hole, except for the last ball, which is much larger and acts as a stop. In later mods, the cable passes through a connection in which friction absorbs the shock.

To use the full burning time of the flare to best advantage, the altitude at which it is released should be about 3000 feet more than the fuze setting. While burning, the flare falls 1500 to 1800 feet.



## Aircraft Parachute Flares Mk 5 Mods 3, 4, 5, 6, 7, 8, 9, and 10

Mk	5	5	5
Mod	3, 4, 5, 6, 7, 8	9	10
Drawing No.	115098	1331779	1331795
Weight (lb)	18	18	18
Burning Time (min)	3	3	3
Candlepower	600,000	1,000,000	1,250,000
Color	Yellow	Yellow	Yellow
Delay (ft)	300-12,000	300-12,000	300-12,000
Ignition Charge	Black powder	Black powder	Black powder
Illuminant Weight (lb)	13	13	13
Maximum Release Speed (knots)	200	200	200
Minimum Release Altitude (ft)	3300	3300	3300
Rate of Descent (ft/min)	450	450	450
Shipping Container Number of Rounds Type Weight (lb)	6 Wood box 170	6 Wood box 170	6 Wood box 170

**Launching.** Mods 3 to 7 are launched from external stations only by Bomb Racks Mk 50, Mk 51, Mk 55, or by flare launching tubes. They are launched internally by Carrier, Parachute Flare, Mk 1. Mods 8 to 10 can be launched from either internal or external stations, from all racks and shackles used by earlier mods, and from Carrier, Parachute Flare Mk 1.

Mk 5 type flares are now supplied with conventional one-lug-type suspension bands as shown in figure 1.6. This type of suspension band will also be furnished as a spare to those early stocks of Flares Mk 5 Mods 3 to 7 that now exist with the old type band, so that these flares may be used with Bomb Rack Mk 55 Mod 0. The flare may be launched manually in extreme emergencies.

**Safety Precautions.** The flare case of Aircraft Parachute Flare Mk 5 Mod 8 is not retained, but falls as a missile hazard. This flare should not be launched over friendly territory.

Aircraft Flares Mk 5 Mods 3 to 7 must

not be released from bomb bays, except in a flare carrier.

**General.** Aircraft Parachute Flare Mk 6 Mods 3, 4, 5, and 6 is of the type ignited by a preset, variable delay time fuze. The fuzes of Aircraft Parachute Flare Mk 6 Mods 3 and 4 are operated by a snap cord that must break before the firing lever is released to strike the primer. The fuzes of Mods 5 and 6 are operated by a cord that is pulled away from the firing lever.

**Operation.** An auxiliary parachute is pushed out of the flare case by expanding gases when the ignition composition of the flare begins to burn. This parachute retards the fall of the parachute tube, which is pulled out of the case along with the pyrotechnic candle. The case falls free. The weight of the candle pulls the parachute out of the parachute tube and it opens, suspending the ignited flare.

To use the full burning time of the flare to best advantage, it should be released at an altitude about 3000 feet greater than the



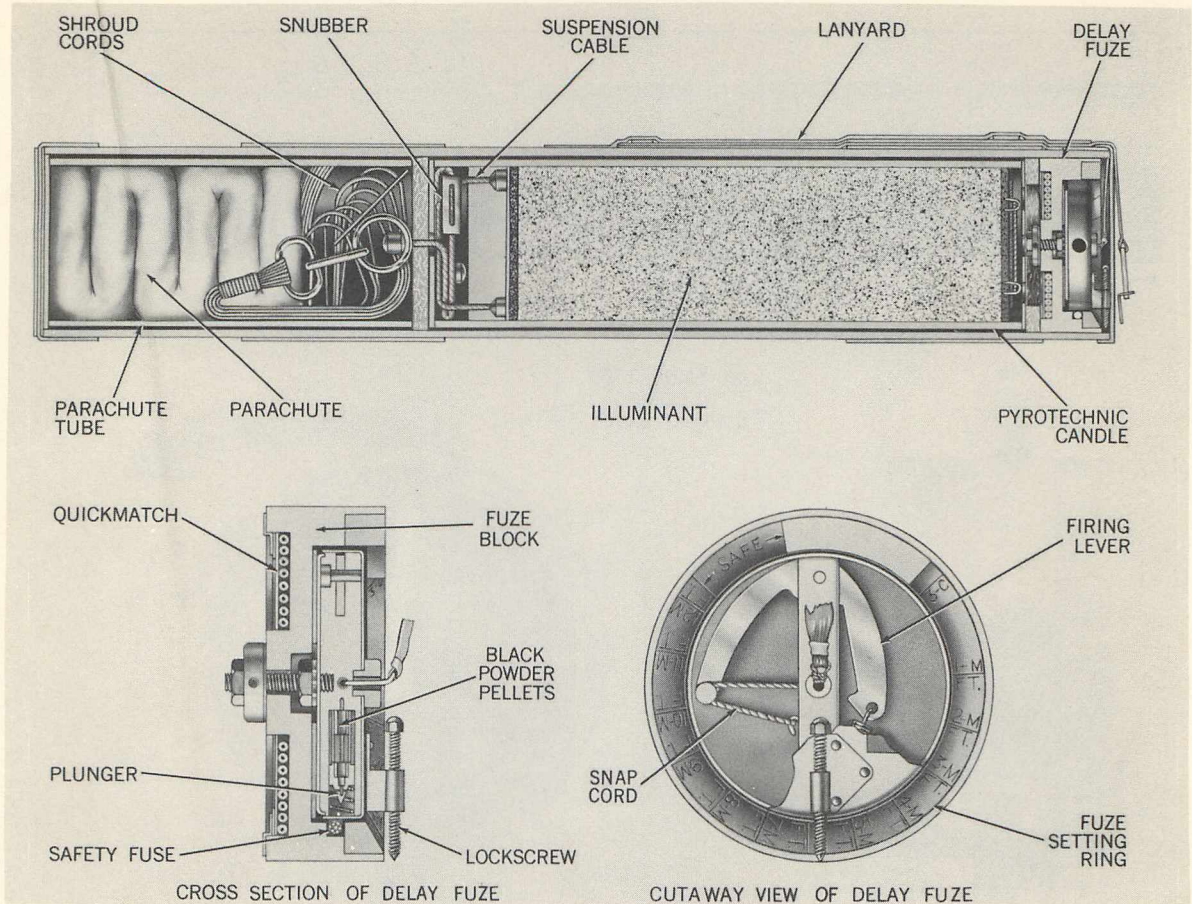


Figure 1.7—Aircraft Parachute Flare Mk 5 Mod 10, Cross Section.

**Aircraft Parachute Flares Mk 6  
Mods 3, 4, 5, and 6**

Mk	6
Mod	3, 4, 5, 6
Drawing No.	115077
Weight (lb)	30
Burning Time (min)	3
Candlepower	1,000,000
Color	Yellow
Delay (ft)	300–12,000
Ignition Charge Type Weight (oz)	Black powder 7.07
Illuminant Weight (lb)	17.4
Maximum Release Speed (knots)	250

Minimum Release Altitude (ft)	3300
Rate of Descent (ft/min)	450
Parachute Diameter (ft)	16 $\frac{1}{4}$
Shipping Container	Wood box
Number of Rounds	
Mods 3, 4, 5	
Mod 6	
Type	176
Weight (lb)	
Mods 3, 4, 5	
Mod 6	102

fuze setting. While burning, the flare falls about 1500 feet.

The fuze of Aircraft Parachute Flare Mk 6 Mod 5 is held in a safe position by the safety screw. This screw must be removed and discarded when the fuze is set for the desired delay.



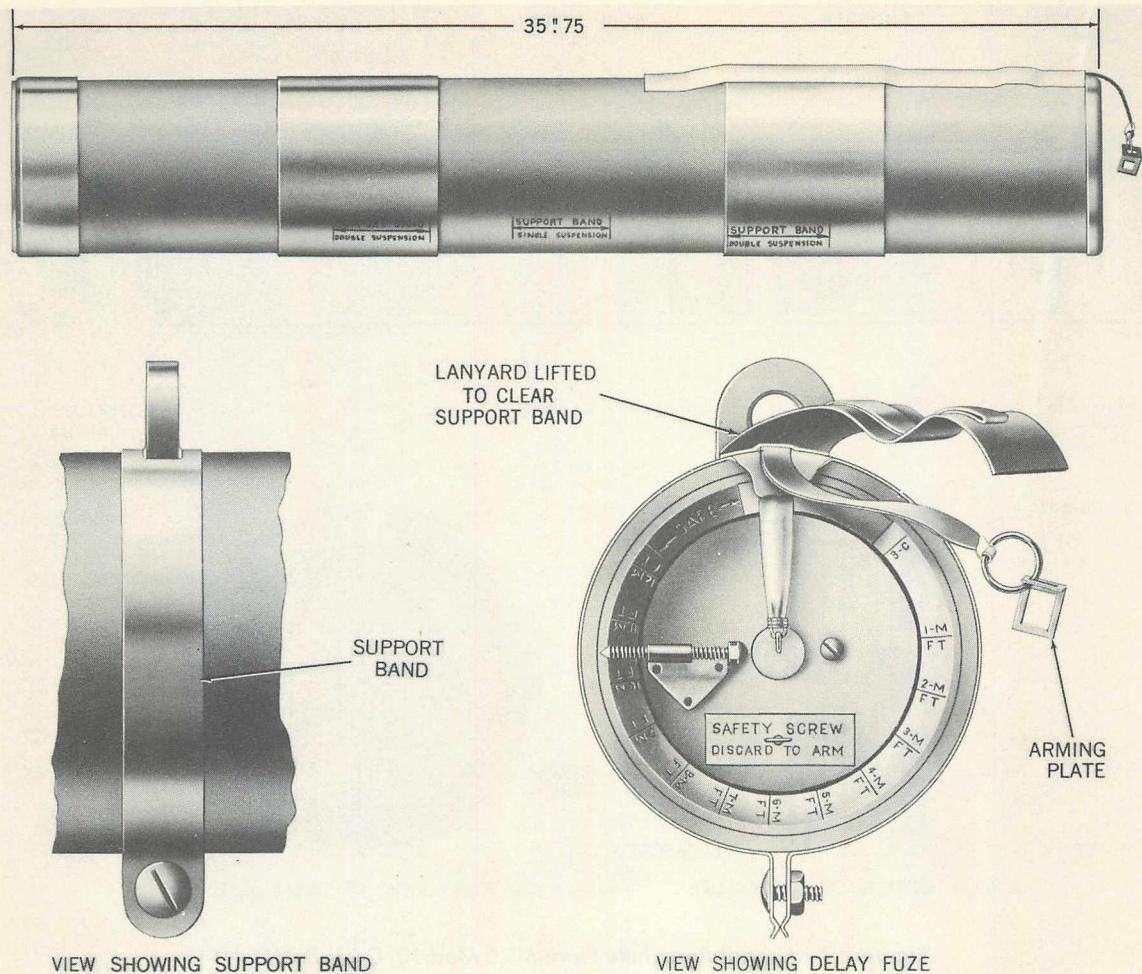


Figure 1.8—Aircraft Parachute Flare Mk 6 Mod 6, External View.

**Launching.** This flare is released from Bomb Racks Mk 50 or Mk 51, or Aircraft Flare Container Mk 1. It may be launched manually in extreme emergencies.

**Safety Precautions.** The general safety precautions mentioned in the first part of this chapter should be observed for this item.

**General.** Aircraft Parachute Flare Mk 6 Mods 0, 1, and 2 was developed for night antisubmarine warfare. It contains a parachute that opens immediately, similar to the Aircraft Parachute Flare Mk 4, but, unlike the Mk 4, it incorporates a 90- or 120-second delay.

The flare has two metal steadying bands against which the steadying forks of the

bomb rack rest. The flare is water repellant but should be kept in its moistureproof metal shipping container when not installed in the plane.

The Mod 0 has no snubber device and its safety fuse is located between the candle and the outside case. The Mods 1 and 2 have snubber devices consisting of solder balls on the suspension cable, as described for the Mk 5 flare. The igniter and safety fuse are located in a hole through the center of the candle. The Mod 0 is used for training only.

**Operation.** When the flare is dropped, one end of the firing lanyard is retained by the plane. The ripcord unwinds from around the wood reel in the flare. The end of the



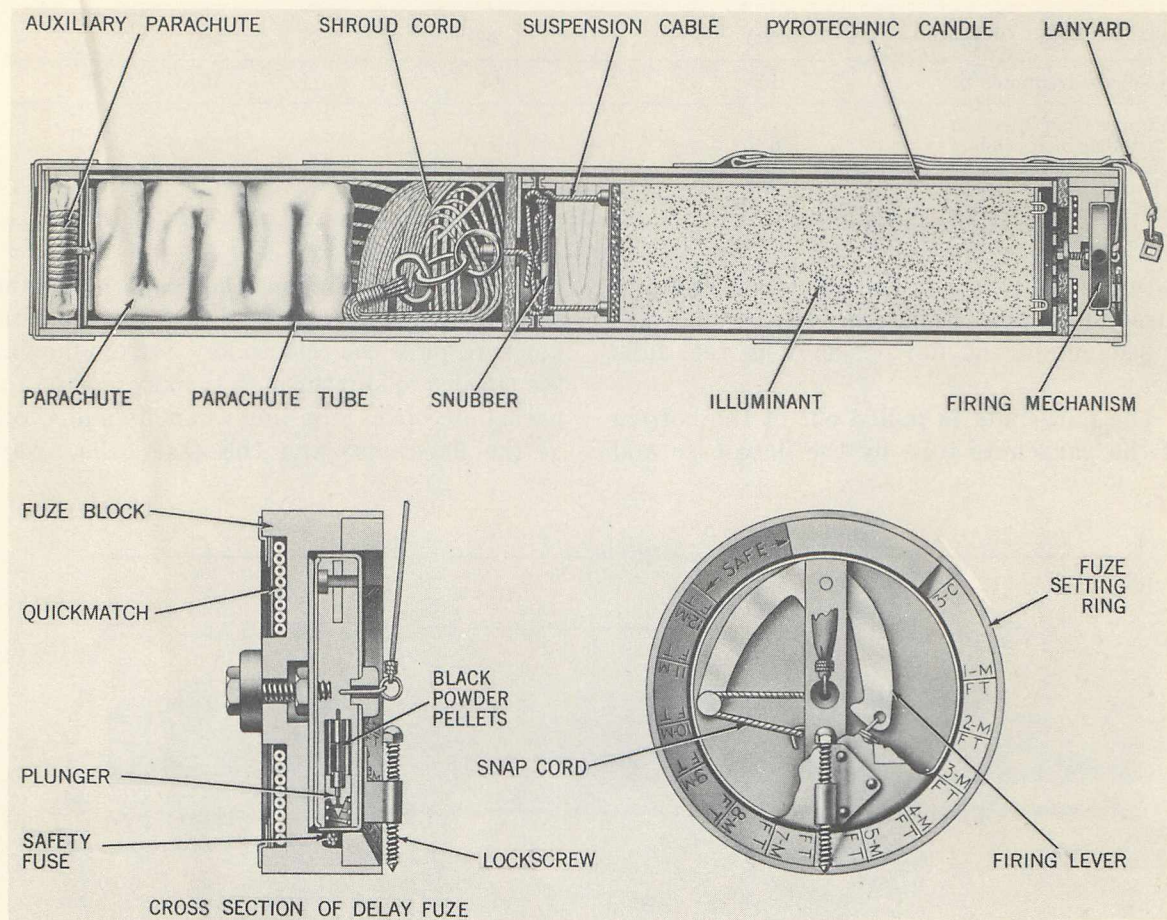


Figure 1.9—Aircraft Parachute Flare Mk 6 Mod 6, Cross Section.

#### Aircraft Parachute Flare Mk 8 Mods 0, 1, and 2

Mk	8	8	8
Mod	0	1	2
Drawing No.	364663	364663	364663
Weight (lb)	18	18	18
Burning Time (min)	3	3	3
Candlepower	500,000	500,000	500,000
Color	Pale yellow	Pale yellow	Pale yellow
Delay (sec)	90	90	120
Ignition Charge Type Weight (oz)	Black powder 7.07	Black powder 7.07	Black powder 7.07
Illuminate Weight (lb)	11	11	11
Maximum Release Speed (knots)	150	220	220
Minimum Release Altitude (ft)	2500	2500	2500



Rate of Descent (ft/min)	500	500	500
Parachute Diameter (ft)	15	15	15
Shipping Container			
Number of Rounds	6	6	6
Type	Wood box	Wood box	Wood box
Weight (lb)	161	161	161

flare case is torn off, and the wood reel and parachute tube (with the parachute) are pulled out of the flare case. The reel falls away.

The parachute is pulled out of the bottom of the parachute tube by the flare case and

the tube falls. When the parachute and shrouds are fully extended, the free release-key cord pulls the release key down, allowing the ripcord to slip through the key. When the parachute opens, the illuminant is pulled out of the flare case and the case falls away.

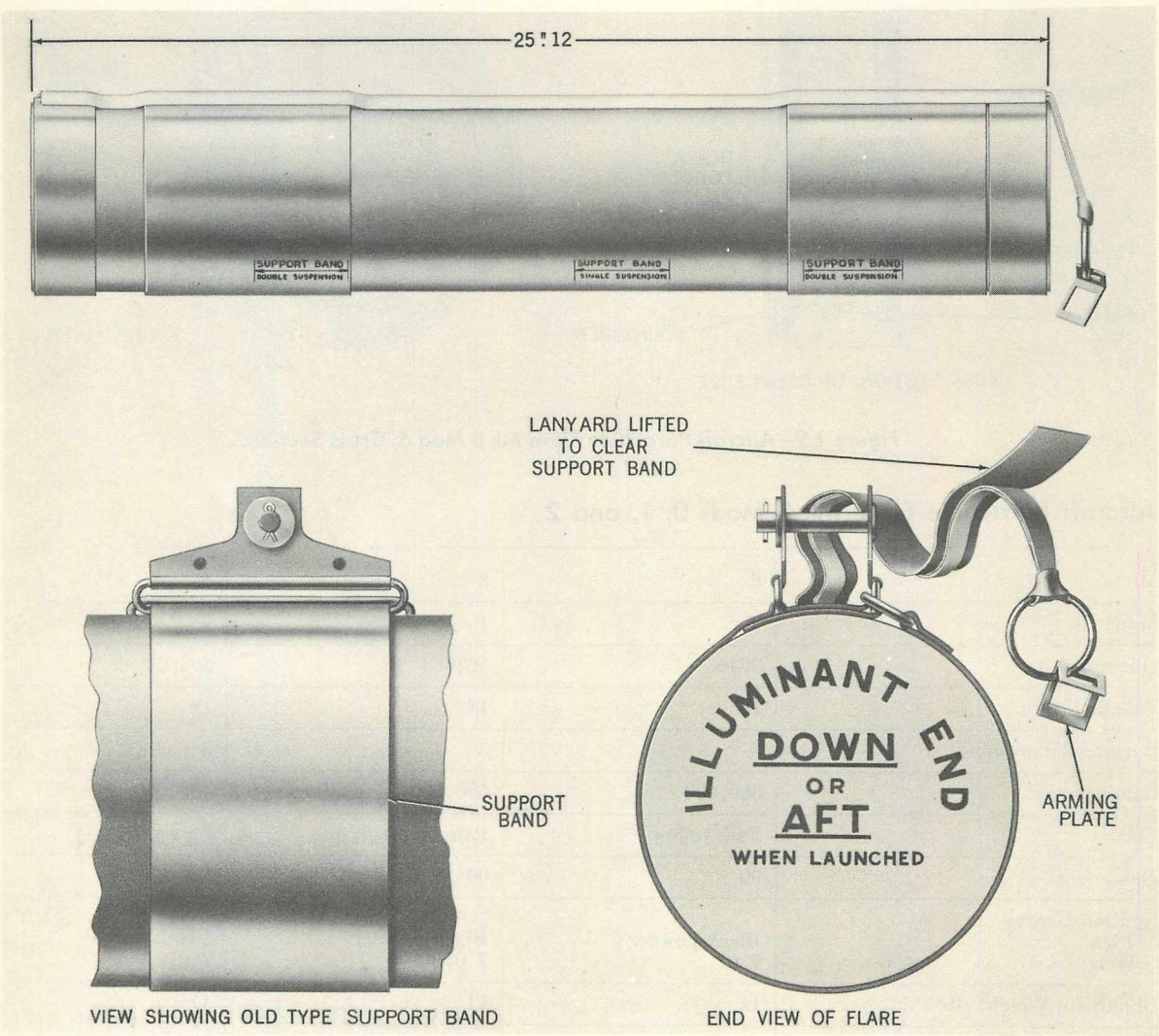


Figure 1.10—Aircraft Parachute Flare Mk 8 Mod 2, External View.



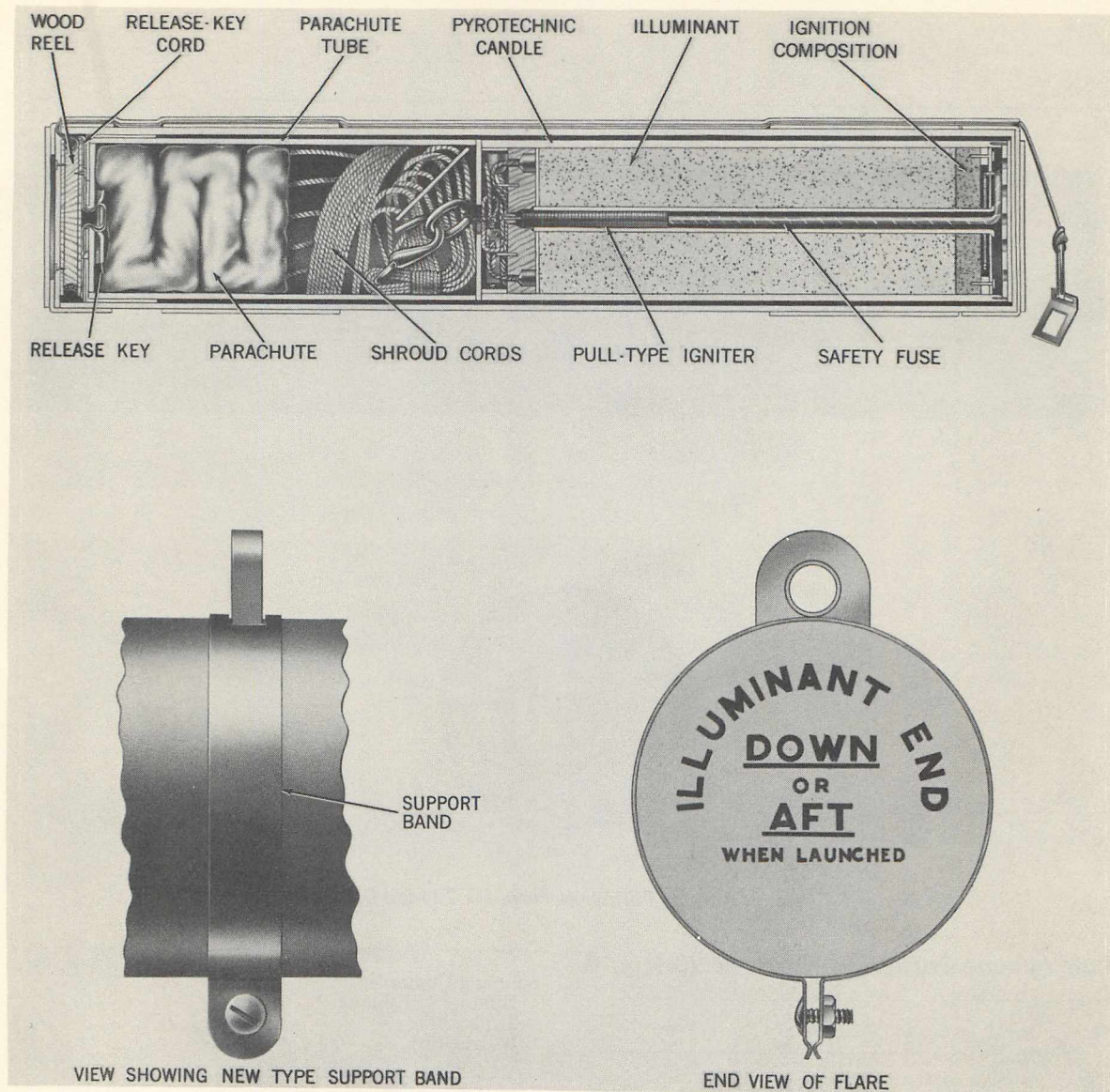


Figure 1.11—Aircraft Parachute Flare Mk 8 Mod 2, Cross Section.

Full suspension is 30 to 50 feet below the plane. Ninety or 120 seconds after the flare is fully suspended, the first fire of the illuminant is ignited by the delay.

**Launching.** These flares are launched from external stations only. They are released from Bomb Racks Mk 50, Mk 51, or Mk 55, or a flare launching tube. Flares Mk 8 Mods 1 and 2 are now supplied with conventional one-lug-type suspension bands as shown in figure 1.10. This type of band will

also be furnished as a spare to those early stocks of Flare Mk 8 that now exist with the old type band, so that these flares may be used with the Bomb Rack Mk 55 Mod 0. The flare may be launched manually in extreme emergencies.

**Safety Precautions.** Aircraft Parachute Flare Mk 8 must not be launched from bomb bays.

Aircraft Parachute Flare Mk 8 Mod 0 must not be launched at speeds in excess of 150 knots.



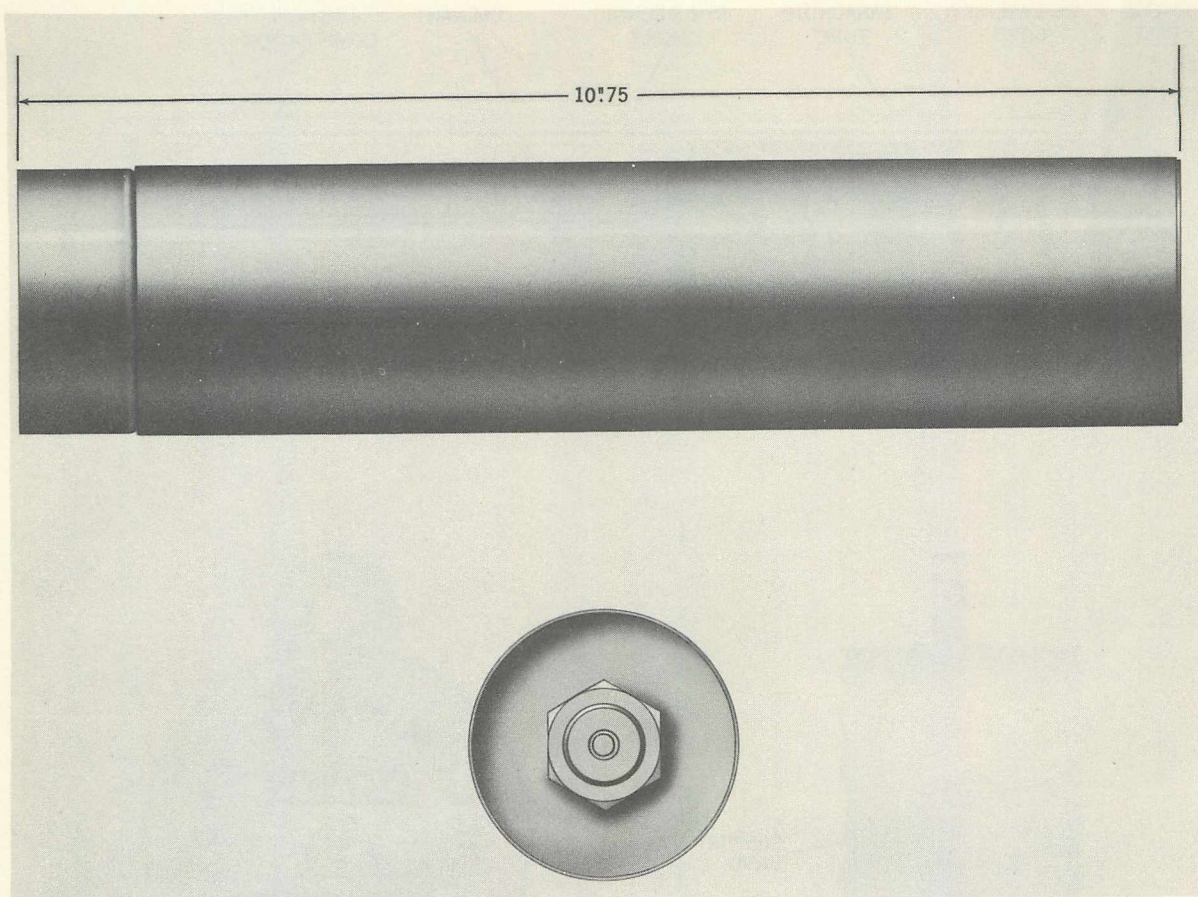


Figure 1.12—High Altitude Parachute Flare Mk 20 Mod 0, External View.

### High Altitude Parachute Flare Mk 20 Mod 0

Mk	20
Mod	0
Drawing No.	421958
Length (in.)	10.75
Diameter (in.)	2.4
Weight (lb)	5
Burning Time (min)	1
Candlepower	85,000
Rate of Fall (fps)	16
Propelling Charge Type	Smokeless powder and black powder mixture
Weight	25
Expelling Charge Type	Black Powder
Weight (grams)	1

Shipping Container	
Number of Rounds	25
Type	Wood
Weight (lb)	118

**General.** High Altitude Parachute Flare Mk 20 Mod 0 is used to identify and illuminate seaplane landing areas at night or to illuminate an island base when low ceilings do not allow proper visibility from normal flying levels. It is fired from the Projector Mk 13 Mod 0 which is described in chapter 4 of this pamphlet.

The flare consists of a steel cylinder closed at one end by a copper cup containing a propelling charge, primer, and a time fuse. The steel cylinder contains a pyrotechnic candle, a parachute, and an expelling charge.



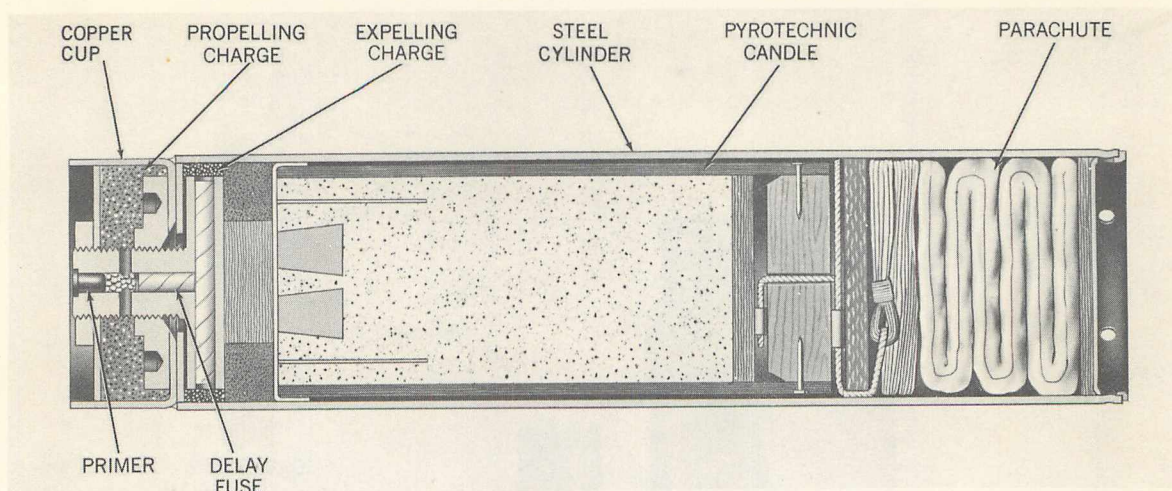


Figure 1.13—High Altitude Parachute Flare Mk 20 Mod 0, Cross Section.

**Operation.** The flare is inserted copper end down into the flare projector, so that it rests on the release pin. The release pin is pulled from the projector by means of a lanyard. The flare falls to the bottom of the tube onto a steel firing pin, firing the primer. The primer sets off the propelling charge and ignites a time fuse. The expanding gases force the copper cup away from the flare and fill the bore of the projector. The flare is propelled 1000 feet into the air, at which time the fuse ignites the expelling charge. The pyrotechnic candle and parachute are expelled, and the expelling charge ignites the candle.

**Safety Precautions.** A suitable barrier should be erected to protect personnel firing this projector.

Firing personnel should wear the steel helmet as a protection against falling empty cases.

In case of a misfire, a hangfire must be suspected, and it is necessary to wait at least 3 minutes before approaching the projector. Then the barrel may be unscrewed from the base, and the flare removed from the barrel. If the misfire occurs at sea, the flare should be dropped overboard; if on shore, the misfired flare should be removed far enough from the firing point so as to be out of the blast area of the projector. Misfired flares should

be disposed of in accordance with current Bureau of Ordnance instructions.

After removing a misfired flare from the barrel, both the barrel and the base should be cleaned as a precaution against further misfires.

#### Trip Parachute Flare M48

Model	M48
Drawing No.	78-0-45
Maximum Length (in.)	9.75
Diameter (in.)	5.5
Weight (lb)	5
Delay (sec)	3
Burning Time (sec)	20
Candlepower	110,000
Color	Yellow-white
Height of Rise (ft)	250-400
Propellant (grains)	75
Pyrotechnic Candle (oz)	7.9
Shipping Container	
Number of Rounds	4 or 10
Type	Wood
Weight (lb)	41 or 88

**General.** Trip Parachute Flare M48 is a warning device actuated by trip wire or by



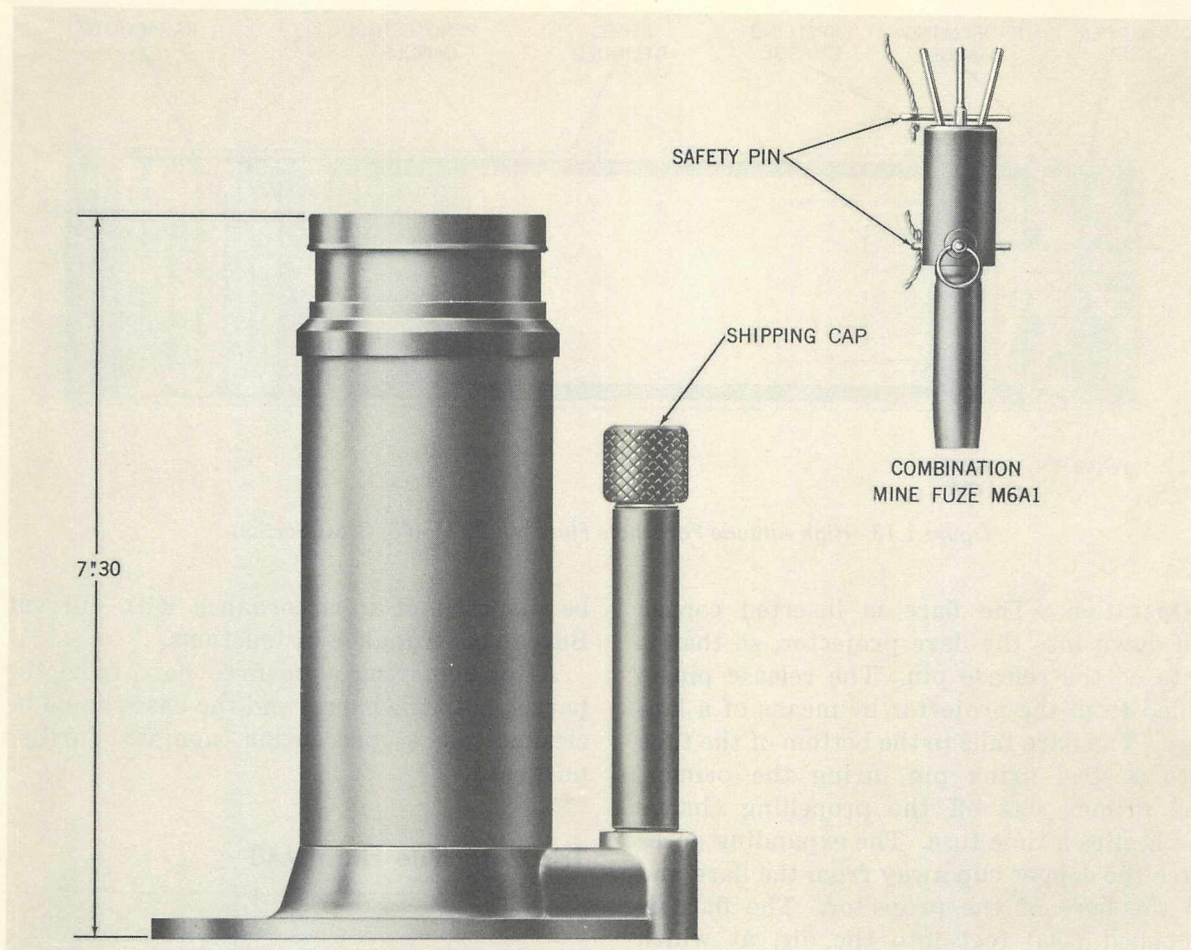


Figure 1.14—Trip Parachute Flare M48, External View.

pressure. It projects a flare case containing a parachute and pyrotechnic candle to an altitude of 250 to 400 feet. The parachute-borne candle ignites when expelled from the flare case. It burns for about 20 seconds with a yellow-white light and illuminates an area with a radius of about 300 yards.

The flare consists of a  $\frac{1}{4}$ -inch pipe and a steel tube approximately  $2\frac{1}{2}$  inches in diameter, which are attached to a base plate that contains the propelling charge. The steel tube contains a time fuse, an expelling charge, a candle, and a parachute assembly. The firing train is composed of a primer, an igniter, and a relay charge.

Combination Mine Fuze M6A1 is shipped with the flare. It has three prongs on its head. It should be noted that the head

normally should turn freely on the narrower body tube. The fuze has two safety pins: one passes through the visible end of the firing pin in the center of the three prongs and the second prevents motion of the release pin. The fuze is actuated in one of two ways: a pressure of 10 to 12 pounds on the prongs, or a pull of 6 to 10 pounds on the release pin. Either action releases the springloaded firing pin, which can then hit the primer.

#### Operation.

**PREPARING THE FLARE FOR FIRING.** The flare is prepared for firing in the following manner.

1. Remove the knurled cap from the igniter fuze assembly. Assemble the fuze.
2. Place the flare in a hole so that the top



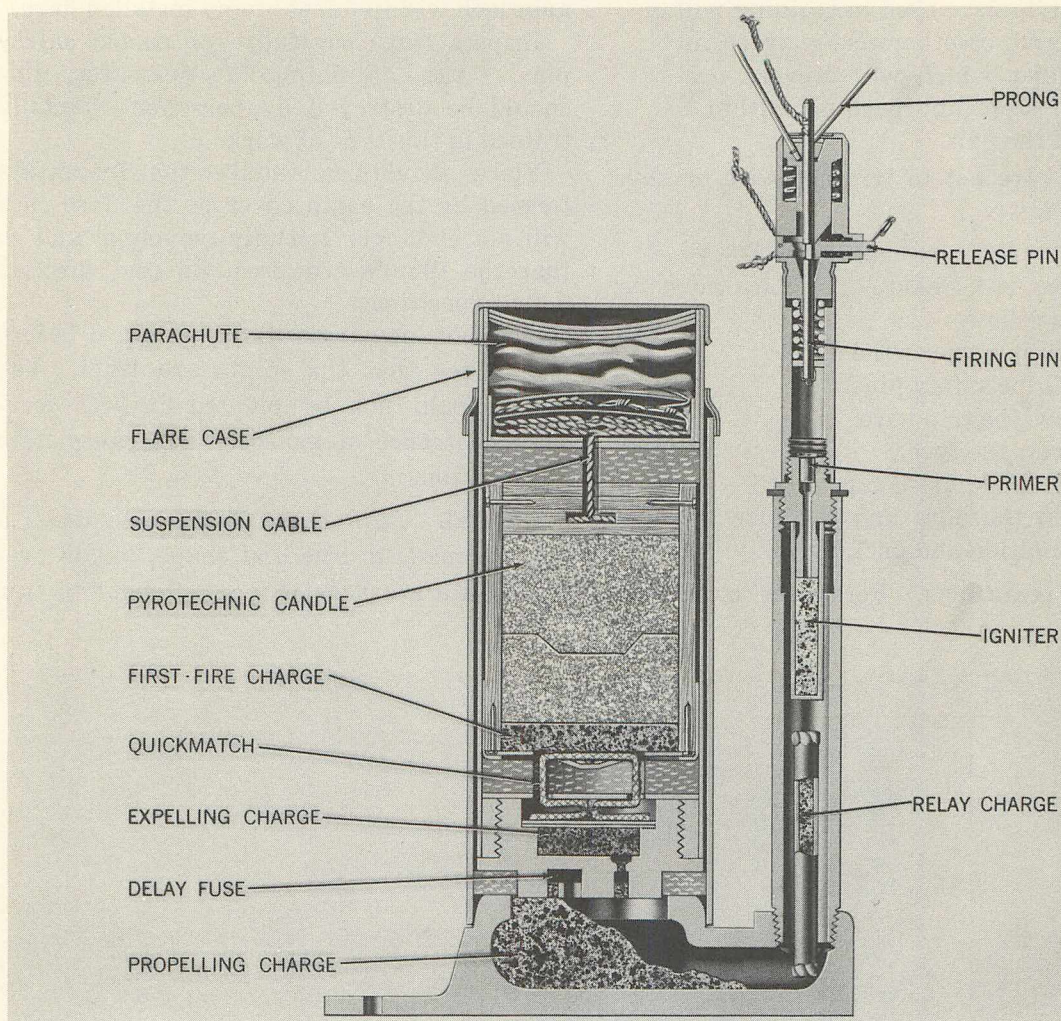


Figure 1.15—Trip Parachute Flare M48, Cross Section.

of the fuze is flush with the surface of the ground. Arrange the cords of the safety pin so they will not be buried when the flare is covered.

3. Tamp the earth around the projector up to the top of the flare.

4. Attach one end of the trip wire or wires to a stake or similar object and run the wire along the ground to the flare. This step may conveniently precede the above steps.

5. Attach the trip wire or wires to the release pin ring. Be sure that there is no tension on any wire.

6. Remove the safety pin opposite the release pin ring.

7. Test the firing-pin safety pin (located between the prongs) to be sure that it does not bind. If it binds, there is tension on the trip wire or the fuze is defective; the release-pin safety pin must be inserted and the defect corrected by either loosening the trip wire or replacing the fuze. If the safety pin does not bind, leave it in place, and cover the flare with untamped soil to bring the ground to its original level.

8. Gently withdraw the safety pin by means of its cord.

#### WARNING

Keep clear of the flare to avoid injury in case of accidental discharge.



Each trip flare used in training will be fenced, or otherwise guarded, in a manner which will prevent personnel from approaching within 6 feet of the flare.

9. Take care not to trip the wire or step on the prongs.

10. Record the location of the flare.

**REMOVING THE FLARE.** The flare must be removed as follows.

1. Carefully uncover the flare.
2. Install the safety pins.
3. Remove the trip wire.
4. Unscrew the fuze.
5. Install the knurled cap.
6. Return the flare and the fuze to their original condition and packing.

**Safety Precautions.** Personnel must not

approach within 6 feet of any installed flare.

Inspect fuzes carefully for rusted safety pins. Fuzes containing defective safety pins should be destroyed by personnel specially trained in this type of work.

Flares should be planted so that fragments formed by the earth cover or the flare case will not endanger friendly personnel and so that the illuminated area will not disclose defense positions.

The flare housing will be examined before use to see that the joints are tight. The flare should not be planted in wet locations; entrance of moisture will cause it to malfunction.

**General.** Trip Flare M49 resembles a hand grenade in size and shape, but is provided with a bracket for attachment to tree

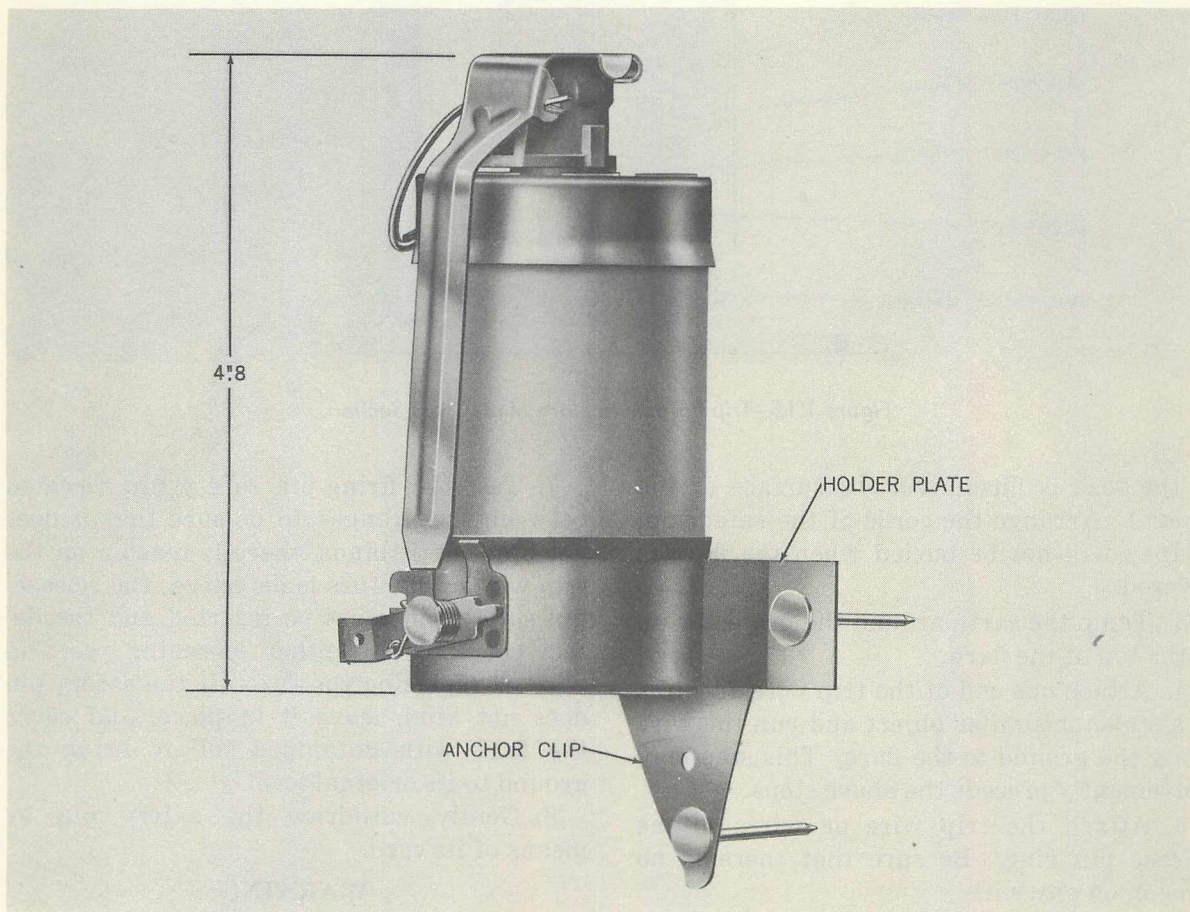


Figure 1.16—Trip Flare M49, External View.



## Trip Flare M49

Model	M49
Drawing No.	78-0-43
Maximum Length (in.)	6
Maximum Diameter (in.)	3.1
Weight (lb)	1.44
Delay (sec)	0
Burning Time (sec)	60
Candlepower	40,000
Flame Color	Yellow or white
Shipping Container Number of Rounds Type Weight (lb)	16 or 25 Wood 45 or 59

or post and a trigger mechanism for firing. Its primary purpose is to illuminate and to give warning of marauding enemy troops. It may be used for signaling.

The flare has a laminated paper body closed at both ends by metal caps. The upper cap has taped holes and a threaded central hole for Trip Fuze M12. The mounting bracket and trigger mechanism are attached to the base cap. The trigger mechanism is spring loaded. A narrow tongue on the trigger will hold the safety lever in place. A trip wire is packed with the flare.

When the trip wire, which is attached to a hole in the lower end of the trigger, is pulled or severed, the trigger will move counterclockwise or clockwise, respectively,

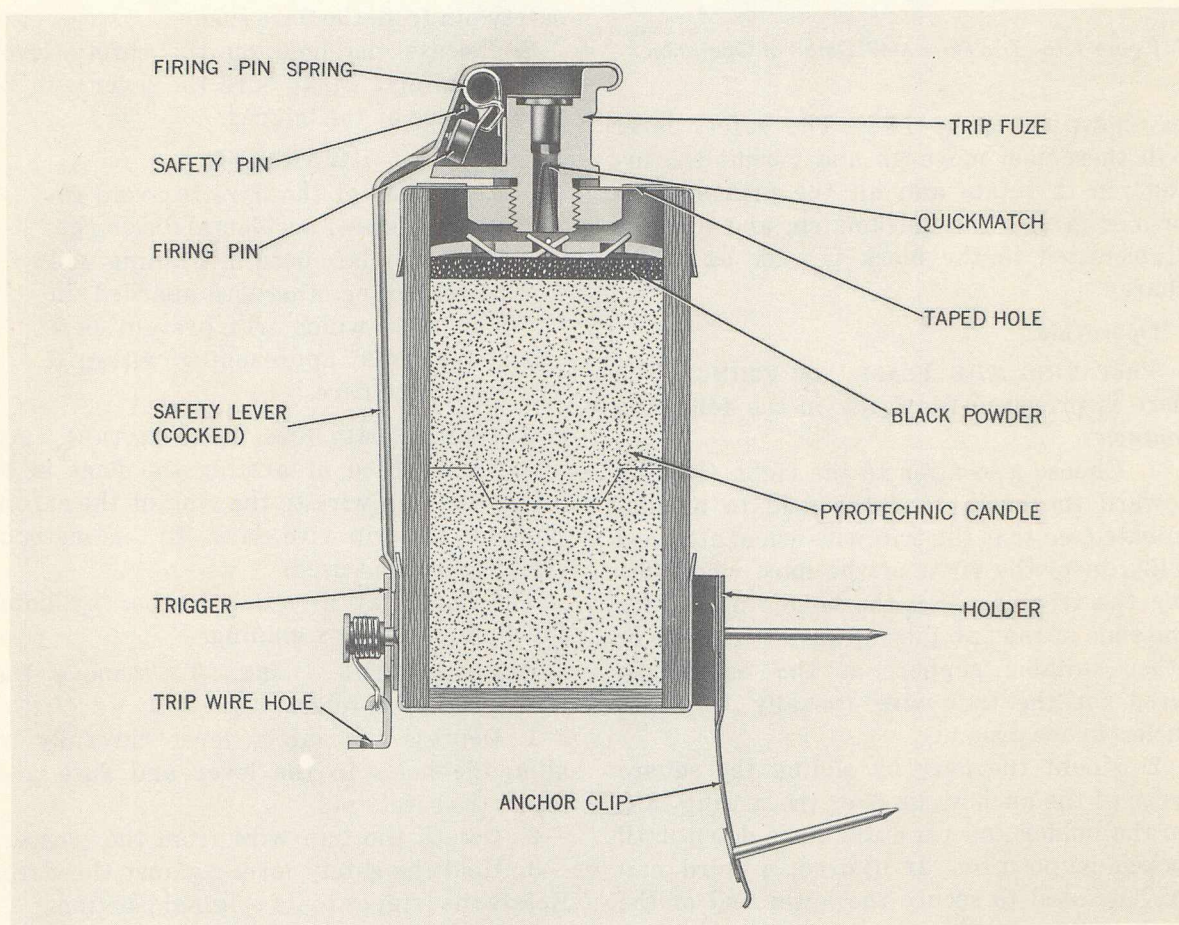


Figure 1.17—Trip Flare M49, Cross Section.



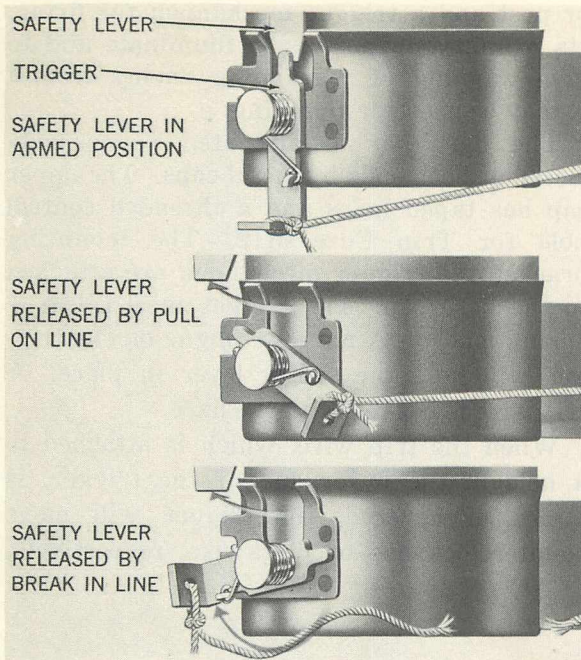


Figure 1.18—Trip Flare M49, Detail of Operation.

as shown in figure 1.18. The safety lever will thereupon move up and permit the firing pin to rotate and hit the primer. The primer ignites the quickmatch, and flame is transmitted to the black powder and flare charge.

#### Operation.

**PREPARING THE FLARE FOR FIRING.** The flare is prepared for firing in the following manner.

1. Choose a location to the right (looking toward the enemy) of the field to be illuminated, so that the trip wire when attached will run to the right of the flare when facing the trigger. Nail the holder plate with the ends of the two tabs upward to a stake or other suitable support at the height desired for the trip wire (usually 15 to 18 inches above ground).

2. Mount the flare by sliding the square holes of the anchor clip over the mating tabs on the holder and press the flare down until locked in position. If desired, a third nail may be used to secure the lower end of the anchor clip.

3. Fasten one end of the trip wire at the

desired distance from the flare (usually about 40 feet) and at the right of the flare when facing the flare trigger. This may conveniently precede steps 1 and 2.

4. Press the fuze safety lever down with one hand. Rotate the trigger counterclockwise a quarter turn so the hole for the wire will be at the 6 o'clock position. The end of the safety lever must be behind the upper end of the trigger.

5. Pull the loose end of the trip wire taut and fasten to the hole in the trigger. At this point, check to see that the trip wire is taut and fastened at both ends. The trigger must be vertical with the safety lever behind the upper end of the trigger. When the safety pin is withdrawn, the safety lever must hold the trigger.

6. Hold the lever with one hand while carefully withdrawing the pull ring and safety pin from the flare fuze.

7. Release the hold on the safety lever very carefully. Make sure the lever will be held in place by the trigger.

#### WARNING

Keep clear of the flare to avoid injury in case of accidental discharge. Each trip flare used in training will be fenced, or otherwise guarded, in a manner which will prevent personnel from approaching within 6 feet of the flare.

**ALTERNATE METHODS OF OPERATION.** An alternate method of arming the flare is to attach the trip wire to the ring of the safety pin, with the trip wire slack. In this method, the trigger is not used.

The flare may also be launched by hand for illumination or signaling.

**REMOVING THE FLARE.** To remove the flare, proceed as follows.

1. Depress the safety lever carefully to aline the holes in the lever and fuze and insert the safety pin.

2. Detach the trip wire from the trigger.

3. Hold the safety lever against the flare. Rotate the trigger to its original position.

4. Remove the nails from the holder plate and anchor clip.



5. Return the flare to its original condition and packing.

**Safety Precautions.** Inspect fuzes carefully for rusted safety pins. Flares containing defective safety pins will be destroyed by personnel trained for this type of work.

Remove the safety pin of the fuze only when the flare is in position and the wire has been connected and adjusted so that the trigger holds the safety lever in place. Do not remove the safety pin at any other time.

When the flare is being used as an illuminating grenade, the pin may be pulled only if the lever is restrained by the throwing hand and held securely until the flare leaves the hand.

Keep in mind the incendiary effect of the flare.

**General.** Trip-Wire Flare Mk 1 Mod 0 is used to reveal the approach of enemy troops. The flare is packed in a watertight container along with the following acces-

### Trip-Wire Flare Mk 1 Mod 0

Mk	1
Mod	0
Drawing No.	344540
Length (in.)	5.38
Diameter (in.)	2.38
Weight (lb)	3.75
Delay	0
Burning Time (sec)	65
Candlepower	75,000
Flame Color	Yellow
Radius of Illuminated Area (ft)	75
Shipping Container	
Number of Rounds	10
Type	Wood
Weight (lb)	70

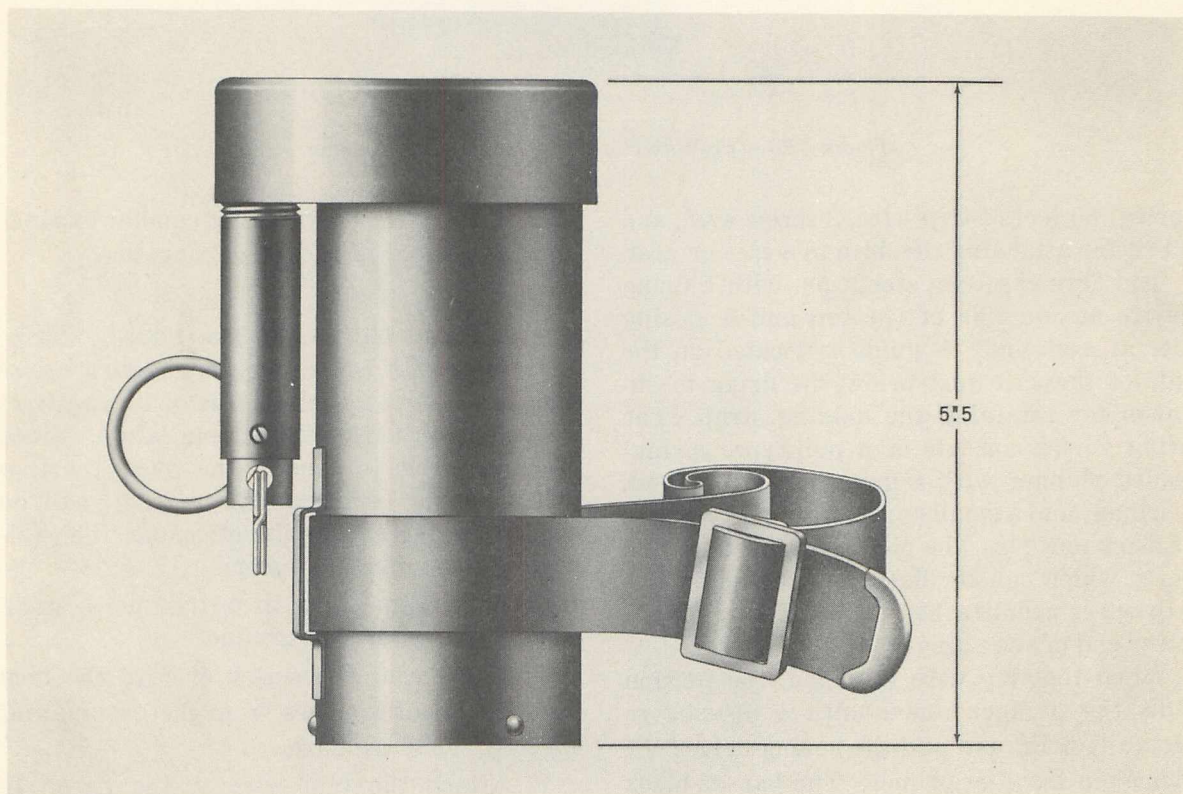


Figure 1.19—Trip-Wire Flare Mk 1 Mod 0, External View.



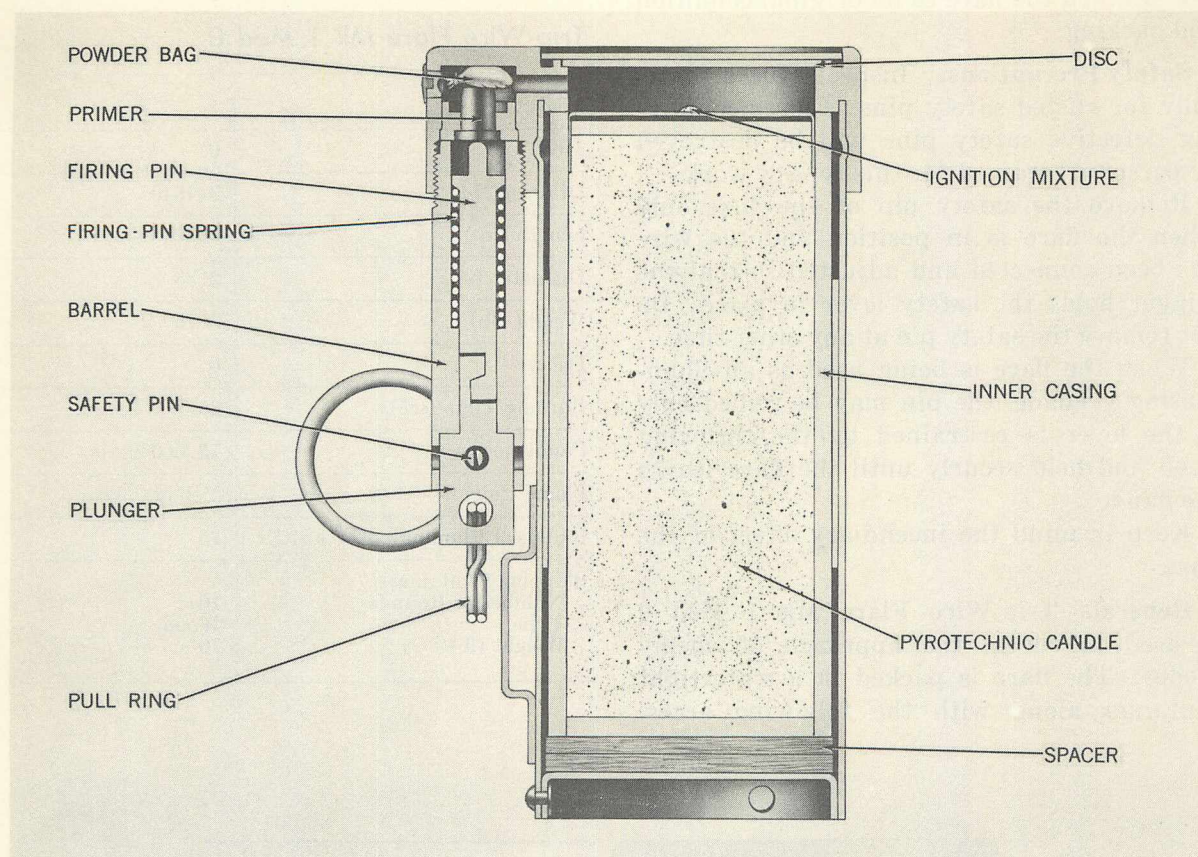


Figure 1.20—Trip-Wire Flare Mk 1 Mod 0, Cross Section.

sories: 80 feet of trip wire, 2 screw eyes, and a belt for attaching the flare to a tree or post.

The flare case is a steel tube with a firing device at one side of the top and a closing disc at each end. A guide is located on the side of the case just below the firing mechanism for retaining the holding strap. The firing device consists of a pull-type, spring-loaded plunger with a firing pin at one end, a primer, and a small bag containing 0.3 gram of black powder. The plunger consists of two parts which can be disengaged. One or two trip wires are attached to a pull ring on the lower end of the plunger.

When the trip wire is pulled, the tension pulls the plunger down until it disengages from the firing pin and the spring drives the firing pin into the primer. The bag of black powder is ignited by the primer. The resulting flash ignites an impregnated muslin disc

and, in turn, the pyrotechnic candle; expanding gases force off the top closing disc.

#### Operation.

**PREPARING THE FLARE FOR FIRING.** Trip-Wire Flare Mk 1 Mod 0 operates like a booby trap; therefore a high degree of ingenuity is required for most efficient operation. Since it is desirable to conceal the flare, the trip wires should be placed where they will be most effective and least noticeable. The following steps must be taken.

1. Secure the flare to a tree or a stake about 3 feet above the ground.
2. Fix one of the screw eyes to the tree or stake about 6 inches from the ground and directly below the flare.
3. Attach the trip wire to the flare. It should be run parallel to the enemy lines. The 80 feet may be run in one direction if



desired or the wire may be divided in any convenient lengths.

4. Pass the free ends of the wires through the screw eye and secure them to the pull ring on the plunger. The wires should not be so taut that the plunger is pulled but, on the other hand, they should sag very little.

5. Arm the flare by pressing up on the plunger and carefully removing the safety pin. Release the plunger slowly and note its travel downward, which should not be more than  $\frac{1}{4}$  inch. If further downward pressure is felt, return the plunger to the up position and replace the safety pin. Adjust the trip wires to allow more slack. The normal downward travel of the plunger is about  $\frac{1}{8}$  inch.

6. Repeat step 5 until there is proper tension on the trip wires. Care should be exercised when replacing the safety pin or releasing plunger so that the flare does not become ignited.

7. Free the plunger of any paint or other

substance by rotating it 90 degrees after the flare is set.

**REMOVING THE FLARE.** To remove the flare, proceed as follows.

1. Push the plunger up slightly, and carefully reinsert the safety pin.

2. Detach the trip wire from the pull ring.

3. Return the flare to its original condition and packing.

**Safety Precautions.** Personnel setting flares should wear steel helmets. The head must be kept below the flare and as far away from it as possible.

When two trip wires are used, they may both be passed through the same screw eyes, but must be attached independently to the plunger.

The flare should be mounted at least 125 yards in advance of a defense position to prevent self-illumination.

The flare can be ignited by a pull of 6 pounds on the plunger after the safety pin has been removed.



## Chapter 2

### MARKERS

#### Introduction

Markers are used to aid navigation by providing a stationary reference point on the surface of the water for determination of the drift of an airplane, to mark the initial point of contact with a submarine, to provide a reference point for further search, to determine wind direction before landing, and to mark the location of the surface for emergency landings at night. Some types of markers produce a slick on the water surface. Other types burn and produce smoke and light. All the signals and markers described in this chapter may be launched from aircraft, and some may also be launched from the deck of a ship.

Markers are used by surface units to locate target areas in antisubmarine warfare; they are also used for air-sea rescue work. Surface markers are relatively small in size and a number of the various markers can be stowed easily in lockers, even on small surface craft.

The effectiveness of markers is dependent on visibility as determined by weather conditions, the observer's altitude, the quality of the daylight, and the position of the sun in relation to the observer. When there is a choice regarding the type of marker to be used, atmospheric conditions must be considered.

**Sea-Marking Materials.** Sea-marking materials are of two types; pigments that float on the surface, and soluble dyes that permeate the water. Floating pigments are visible both from the air and from the surface and are suitable for either use. Surface reflection of light at acute angles reduces the color contrast of the dye markers when viewed from the surface, but not when viewed from the air. They are therefore more visible from aircraft than from surface craft. Dye markers are particularly useful when special pack-

aging or mixing with other substances is desired.

Chrome yellow pigment is used in depth charge markers for general purpose marking for observation from air or surface.

Rhodamine BXP red fluorescent dye and uranine green fluorescent dye are available in 1-pound cans. These dyes are used when observation from the air is required for general purposes when the depth charge markers loaded with chrome yellow pigment are not available. They are also used when small quantities of sea-marking materials will suffice or when marker material is required to be mixed with other materials or placed in special dispensers or packages. Uranine green fluorescent dye, however, is widely used as a distress signal and in search and rescue operations at sea. It should not be used for other than emergency purposes when alternate sea-marking materials can be used.

These materials must be shipped and stowed in moistureproof containers to prevent caking.

**OPERATION.** Surface markers are launched by being thrown overboard at the desired location. Some markers are actuated by a grenade-type mechanism that explodes a bursting charge, spreading dye or pigment over the water. Other markers are activated by chemical action with water. Cans of marking material are available for use in improvising methods of dispersion for general marking purposes.

**MARKING.** Markers are stenciled with nomenclature and other pertinent information and, in some cases, instructions for launching or use.

**HANDLING AND STOWAGE.** The handling and stowage of markers requires considera-



ble care. Some markers are very fragile and subject to breakage; they should therefore be handled carefully at all times. The stowage must be dry because slick-producing materials are subject to deterioration when in contact with moisture. Water-activated markers must be stowed only in a dry place; they must not be stowed where there is a sprinkler system. A fire in a locker containing these markers must not be fought with water, since this would increase the chemical action.

These markers must be periodically checked for serviceability and leaks in seams or loose tear strips. Slowly leaking gas will not be ignited spontaneously and the stowage may be flooded with an explosive gas mixture. All markers must be stowed out of the direct rays of the sun in a place where the temperature does not exceed 100° F.

**DISPOSAL.** Defective, damaged, or otherwise unserviceable markers are to be disposed of as indicated in current directives.

**GENERAL SAFETY PRECAUTIONS.** Stowage areas containing water-activated markers must be checked periodically for the presence of gas from leaking markers.

Smoking or carrying lighted cigars, cigarettes, or pipes is not permitted in the vicinity of, or while handling, markers containing explosives.

When a cartridge-type marker misfires, two more attempts must be made to fire it, and then the cartridge may be unloaded only after waiting for at least 30 seconds because of the possibility of hangfire.

Markers stowed on an aircraft must be secured to prevent damage either to the markers or to the aircraft.

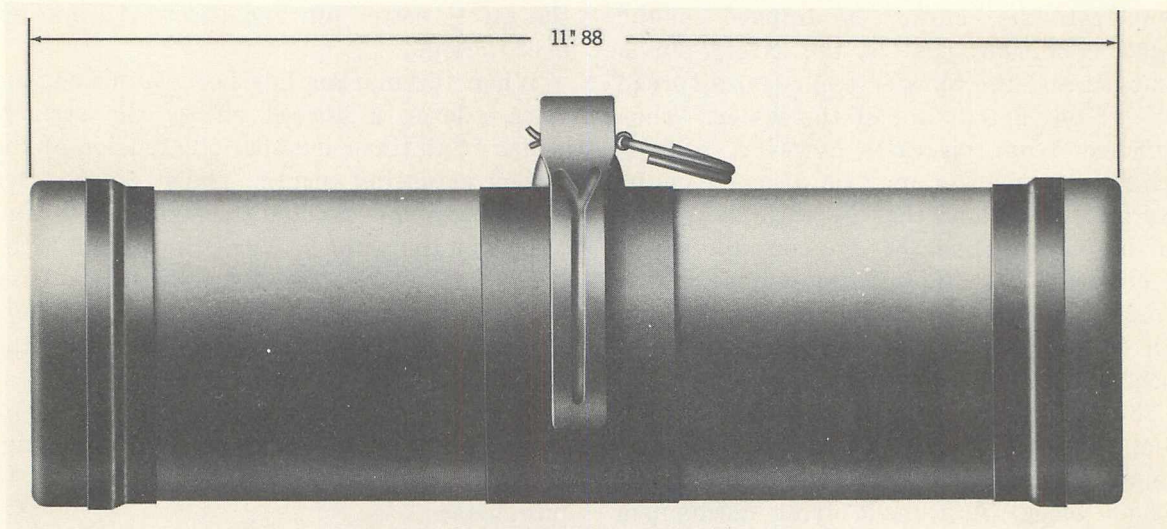


Figure 2.1—Depth Charge Marker Mk 1 Mod 2, External View.

### Depth Charge Marker Mk 1 Mods 2 and 3

Mk	1	1
Mod	2	3
Drawing No.	344487	1211714
Weight (lb)	3.6	3.6
Maximum Release Altitude (ft)	1000	1000
Delay (sec)	15	15



Color	Yellow-green	Chrome yellow
Material	Fluorescein dye	Pigment
Visibility (yd) Surface Air	3000 10,000	3000 10,000
Primer Mk Mod	5 0	5 0
Bursting Charge Type Weight (oz)	Black powder 1.06	Black powder 1.06
Shipping Container Number of Rounds Type Weight (lb)	10 Wood box 68	10 Wood box 68

**General.** Depth Charge Marker Mk 1 Mods 2 and 3 may be launched by hand from the decks of surface vessels or from aircraft at any altitude. When launched from surface craft or from aircraft flying lower than 1000 feet, the marker is dropped in the armed condition; that is, the safety pin is removed and the burster explodes to spread the dye on the surface of the water. When launched from aircraft, however, at any altitude, the marker may be dropped in the unarmed condition; that is, with the safety pin in place. Then the dye containers will be crushed upon hitting the surface of the water. The slick produced in this instance will be only slightly smaller than that produced when the marker is dropped armed.

The marker consists of two dye- or pigment-filled, cylindrical, kraft-paper containers, each attached to a flat side of a circular wooden block. A grenade firing mechanism is mounted on the wood block. A plastic tube that holds a bursting charge of black powder extends through the wood block into both containers. Each container is filled with a dye powder or a pigment which appears yellow or yellow-green on the water. The dye contained in the marker Mk 1 Mod 2 has a fluorescein concentration of about 86 percent. The markers are water-proofed with a bakelite lacquer.

The marker has a diameter of  $3\frac{1}{2}$  inches and a length of  $11\frac{7}{8}$  inches. The firing mechanism protrudes  $\frac{7}{8}$  inch from one side.

**Operation.** To launch the marker from surface craft, or from aircraft at altitudes up to 1000 feet, grasp it firmly in one hand, holding the release lever against the body of the marker. Pull the safety ring to pull out the safety cotter pin and throw the marker over the side.

When the marker has been launched, the release lever is forced off by the striker, which at all times is under the tension of the striker actuating spring. The striker rotates about the hinge pin, and the striker point impinges on the primer. The primer ignites the time fuse which introduces a short delay before igniting the bursting charge. The expanding gases burst the dye containers and spread the dye on the water. The size of the colored slick area will be governed by the amount of dispersion of the insoluble pigment. The spot will last approximately 45 minutes.

**Safety Precautions.** In addition to the general safety precautions outlined at the beginning of this chapter, the following special precautions should be observed.

Be sure, after removing the safety cotter pin, to hold the release lever securely against the body of the marker until the marker is launched. Only a small movement of the release lever is required to free the striker.

Do not remove the safety cotter pin from the firing mechanism unless the marker is held properly and is ready for launching.



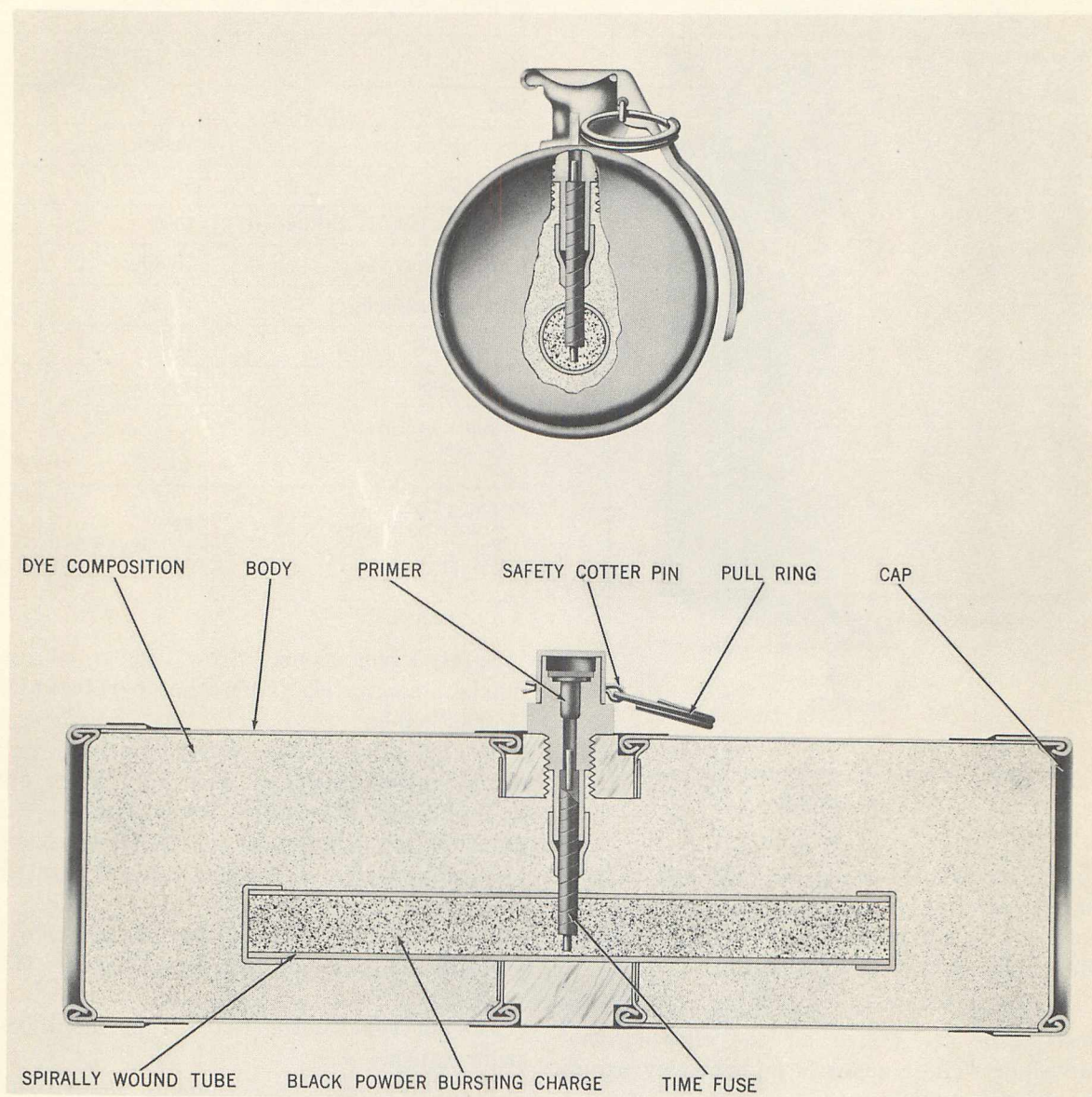


Figure 2.2—Depth Charge Marker Mk 1 Mod 2, Cross Section.

Do not replace the safety cotter pin after it has been removed. No attempt shall be made to render the marker "Safe" for stowage or reuse. Once prepared for use, it must be expended.

Do not remove the firing mechanism from the marker under any circumstances.

**General.** Depth Charge Marker Mk 2 Mod 0 is used to indicate the initial point of contact with submarines, and to provide a

reference point for further search and attack during night operations. This marker may be launched by hand from aircraft at altitudes up to 3000 feet. After impact with the water, the gases generated produce a flame about 9 inches high.

A centrally located tube within the can contains a small charge of calcium phosphide. The main charge of calcium carbide surrounds this tube. A tear strip with a pull



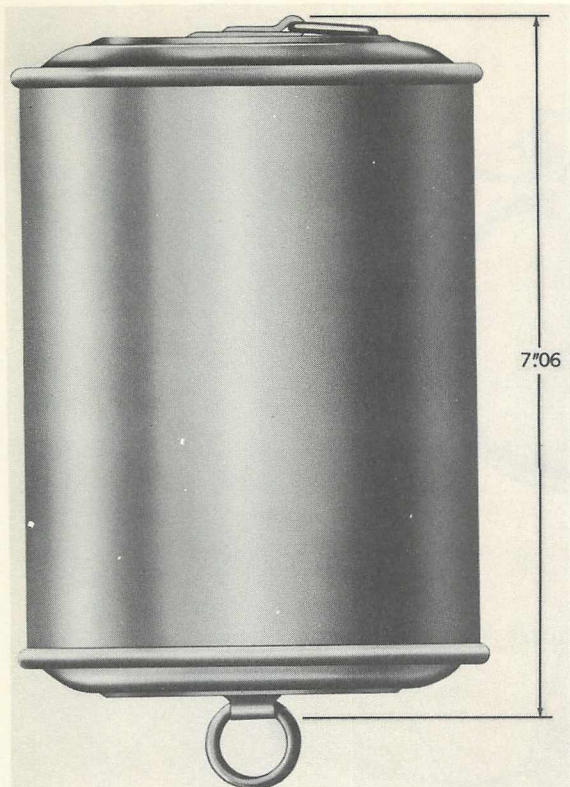


Figure 2.3—Depth Charge Marker Mk 2 Mod 0,  
External View.

ring attached is located on each end of the container. Each tear strip seals two small holes that permit the entrance of water when the marker is thrown overboard.

**Operation.** Before launching, the two tear strips are pulled off the ends of the container. The marker is launched by being thrown overboard.

Water enters the container through the holes in the bottom and reacts with both the calcium carbide and the calcium phosphide. Acetylene (an inflammable gas) and phosphine (a spontaneously ignited gas) are produced for at least 45 minutes. Both gases escape from the holes in the top, and ignite within about 70 to 90 seconds after impact with the water. In extremely cold weather, the ignition delay may be longer. If the flame is put out by rough water, the gases will ignite again. No smoke is emitted during the burning period.

### Depth Charge Marker Mk 2 Mod 0

Mk	2
Mod	0
Drawing No.	344505
Weight (lb)	3
Maximum Release Altitude (ft)	3000
Ignition Delay (sec)	70-90
Burning Time (min)	45-55
Candlepower	150
Flame Color	Yellow
Visibility (miles)	
Surface	4
Air	10
Shipping Container	
Number of Rounds	12
Type	Cardboard box
Weight (lb)	36

**Safety Precautions.** Stow depth charge markers separately from other pyrotechnics, if practicable.

Do not stow depth charge markers in a compartment equipped with sprinklers and do not fight fires with water because the markers are ignited by chemical reactions between water and the chemicals within the markers.

Do not handle the marker or remove it from its container by grasping the tear strip pull ring.

Do not remove the tear strips until just prior to use.

Make periodic inspections to insure that one or both tear strips have not been accidentally removed, and that no punctures exist in the case or leaks in the seams. Markers in which the watertight integrity has been broken may produce acetylene and phosphine, gradually and without ignition. These gases may collect in enclosed places to produce hazardous concentrations that can explode if ignited.

**General.** Night Drift Signal Mk 5 Mod 4 produces light and smoke. The signal consists of a die-cast nose, a wood body, and a sheet-metal tail. The nose contains a water-



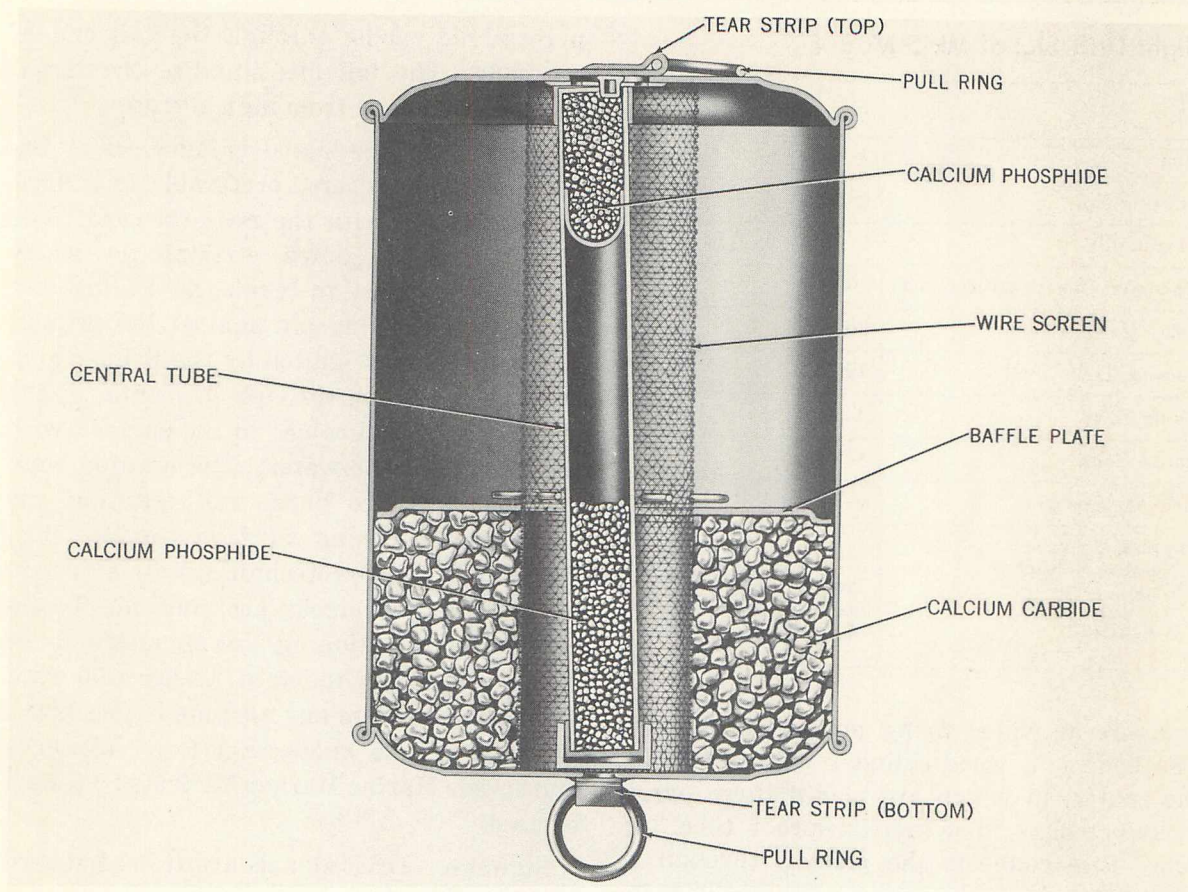


Figure 2.4—Depth Charge Marker Mk 2 Mod 0, Cross Section.

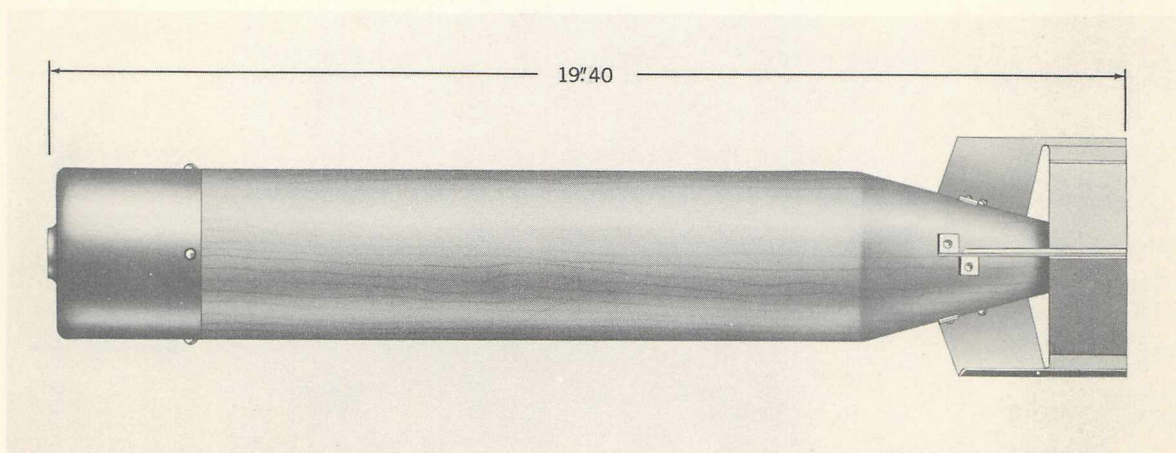


Figure 2.5—Night Drift Signal Mk 5 Mod 4, External View.



## Night Drift Signal Mk 5 Mod 4

Mk	5		
Mod	4		
Drawing No.	982534		
Weight (lb)	3.6		
Maximum Release Altitude (ft)	10,000		
Delay (sec)	30-35		
Burning Time (min)	12		
Flame Color	Yellow		
Smoke Color	White		
Visibility (miles)	6-7		
Shipping Container			
Number of Rounds	8	20	25
Type	Wood box	Wood box	Wood box
Weight (lb)	60	110	125

pressure activated firing pin and a primer. The body is a wood cylinder with a hole in the center, in which are placed three pyrotechnic pellets in a moistureproof tube. A delay fuse connects the primer, through a 0.22-inch hole in the center of the pellets, to the quickmatch and first-fire composition at the tail end of the signal. The body is tapered at the tail end where the tail fins are fastened to the body. A capped hole leads from the

pyrotechnic candle through the tail end of the body. The tail fins stabilize the signal when it is dropped from high altitudes.

**Operation.** The signal is launched by being thrown overboard, preferably in a horizontal position with the nose forward. The signal falls nose down, striking the water with enough force to break the sealing disc and drive the firing pin against the primer. The delay fuse is ignited by the primer and, while it is burning through the center of the pellets, the signal comes to the surface with the tail out of the water. The ignition composition starts to burn, and escaping gas blows out the closing cap from the tail opening. When the pyrotechnic candle starts to burn, flame and smoke are emitted. To insure correct functioning, this signal should be dropped from altitudes of at least 50 feet, any speed; or from any altitude if speeds are in excess of 125 knots. For lower altitudes and speeds Marine Marker Mk 9 Mod 0 should be used.

**Stowage.** Drift signals are stowed aboard aircraft in easily accessible racks.

**Safety Precautions.** The general safety precautions stated in the first part of this chapter should be observed for this item.

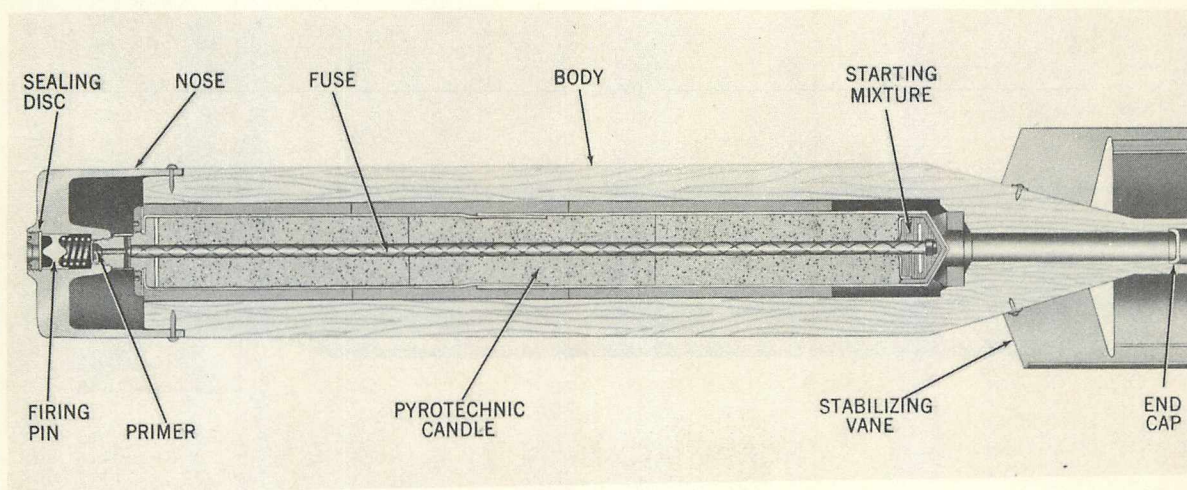


Figure 2.6—Night Drift Signal Mk 5 Mod 4, Cross Section.



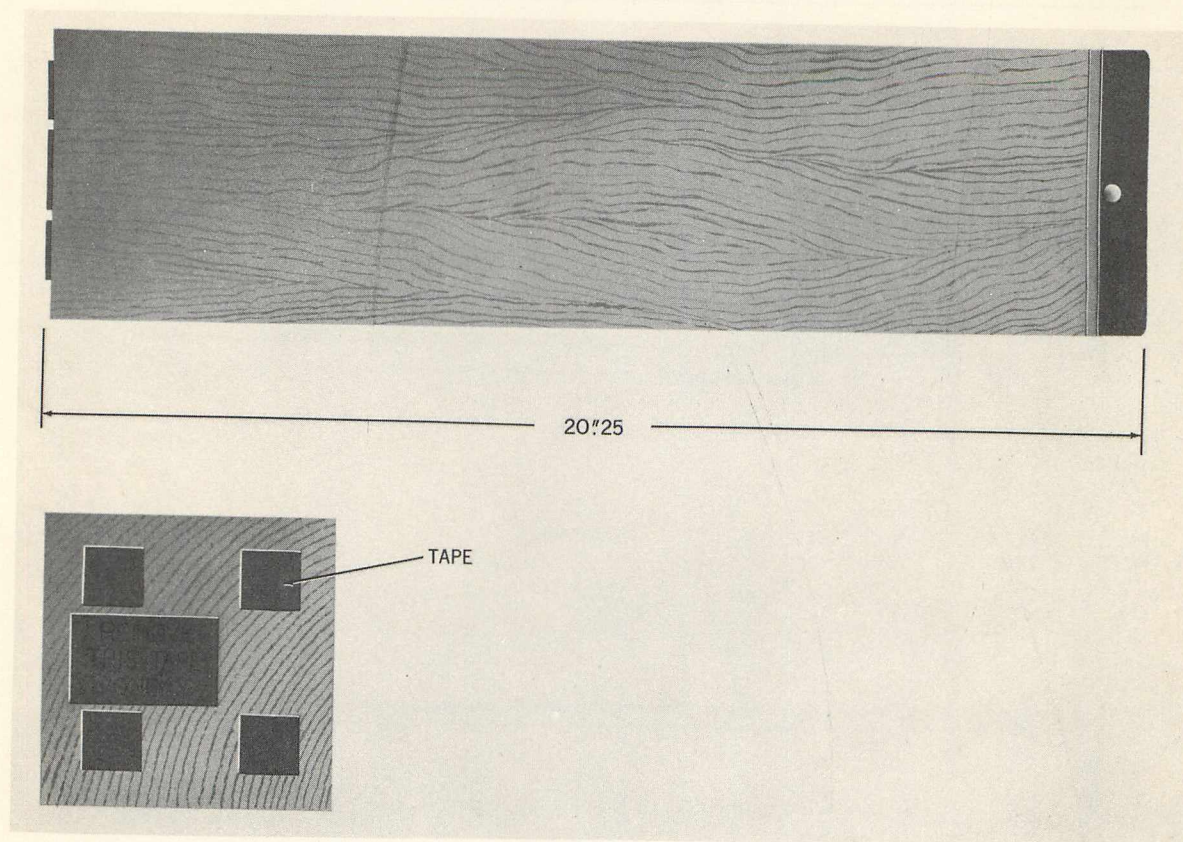


Figure 2.7—Aircraft Float Light Mk 6 Mod 2, External View.

#### Aircraft Float Light Mk 6 Mod 2

Mk	6
Mod	2
Drawing No.	344698
Weight (lb)	15.5
Release Altitude (ft)	0-5000
Delay (sec)	90
Burning Time (min)	40-60
Flame Color	Yellow
Smoke Color	Gray-white
Visibility (miles)	5-10
Illuminant Type Weight (lb)	Red phosphorous 3.97
Shipping Container Number of Rounds Type Weight (lb)	6 Wood box 120

**General.** Aircraft Float Light Mk 6 Mod 2 provides a long-burning surface marker for day or night. The light consists of a flat, die-cast metal nose piece and a square wood body. The metal nose piece stabilizes the light when dropped from an aircraft and causes the light to float upright in the water. There are four holes through the length of the body. Each hole contains a pyrotechnic candle enclosed in a moistureproof tube with fuse connections to the other candles so that the candles burn one after the other. Each hole is capped at the tail end. Through the center of the body is a hole containing the delay fuse, connected to the first candle to be ignited; a pull-type igniter is located at the tail end. The igniter pull ring and each capped hole containing a candle are covered with tape.

**Operation.** The light is launched by pulling off the tape covering the igniter pull



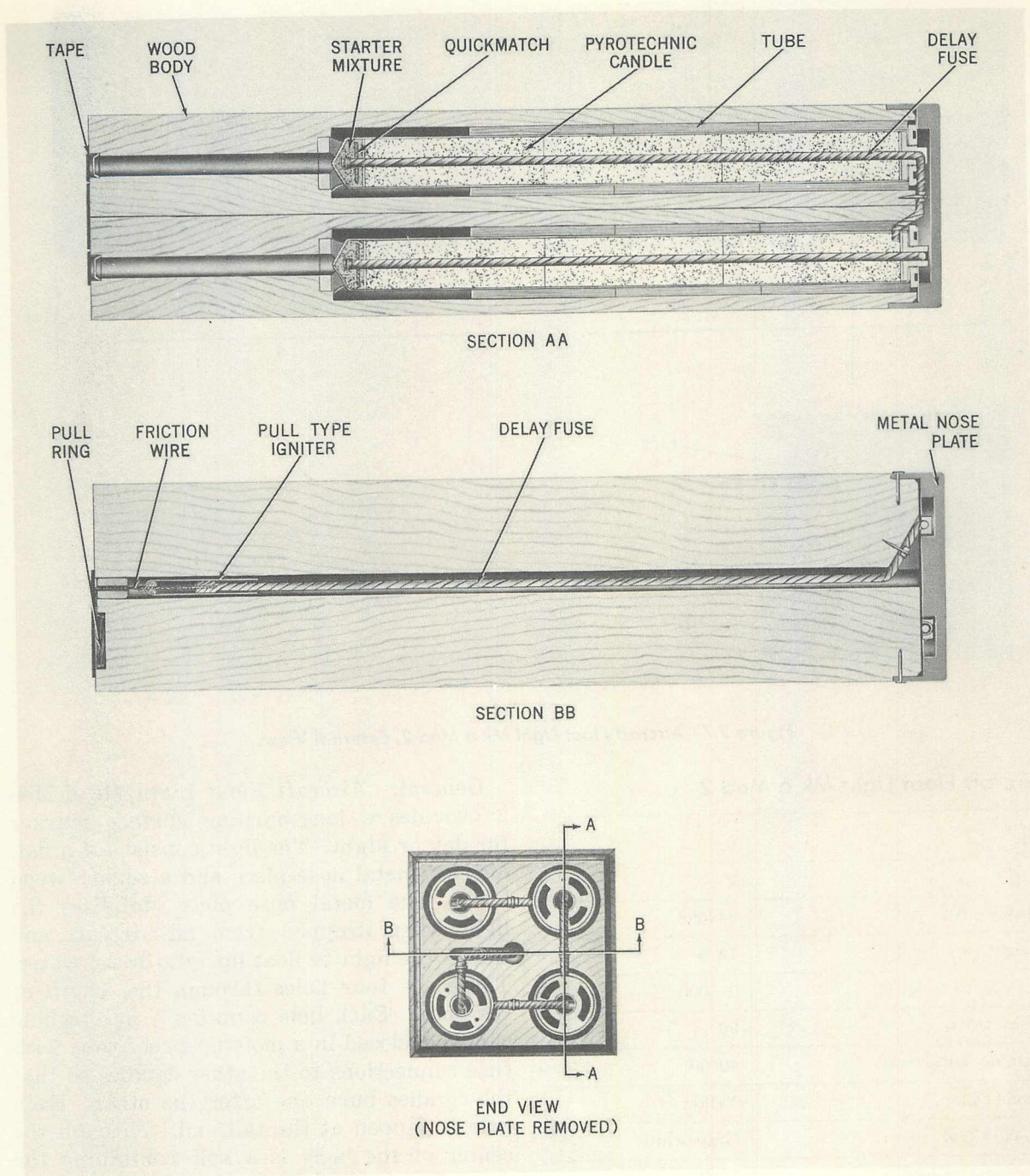


Figure 2.8—Aircraft Float Light Mk 6 Mod 2, Cross Section.

ring. This ignites the delay fuse. The light must then immediately be thrown overboard.

The light may also be ignited by attaching a lanyard to the pull ring and securing the other end to some substantial part of the

aircraft structure. The light is then thrown overboard and is ignited by the pull ring being retained by the lanyard.

The delay fuse burns to the first candle. When the candle begins to burn, expanding



gases force off the cap and adhesive tape over the hole above the candle, allowing smoke and flame to be emitted. When the first candle is nearly burned out, the connecting fuse ignites the next candle. This process continues until all four candles have burned.

**Stowage.** Float lights should be stowed in pyrotechnic lockers above decks, if possible, because of the large quantity of smoke produced in the event of fire. They should be stowed in their original shipping containers until placed aboard aircraft in ready condition. Individual rounds of recent production are packed in moisture/vaporproof containers.

**Safety Precautions.** Do not remove pieces of adhesive tape covering the holes above the candles.

Launch the light immediately after the igniter pull ring has been pulled and ignition has been started.

### Marine Marker Mk 7 Mod 2

Mk	7
Mod	2
Drawing No.	490901
Diameter (in.)	2.92
Weight (lb)	3
Maximum Release Altitude (ft)	1000
Delay (sec)	30-35
Burning Time (min)	12
Flame Color	Yellow
Smoke Color	White
Visibility (miles)	6-7
Shipping Container	8 Wood box 60
Number of Rounds	
Type	
Weight (lb)	60

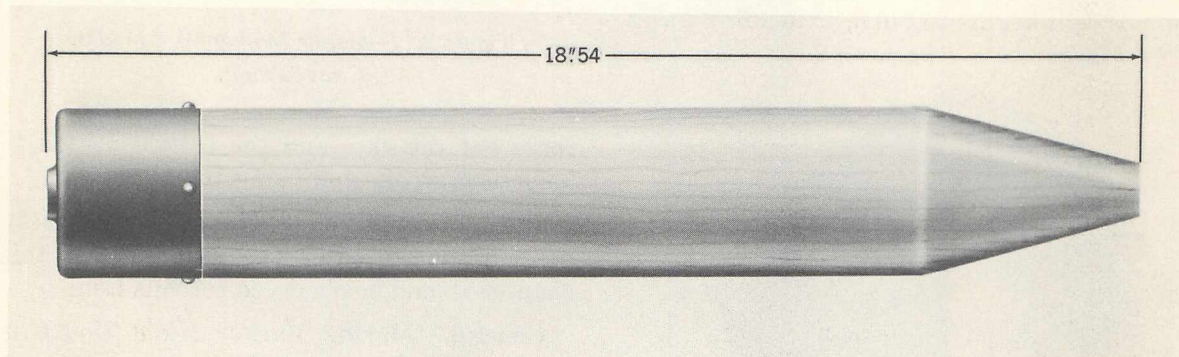


Figure 2.9—Marine Marker Mk 7 Mod 2, External View.

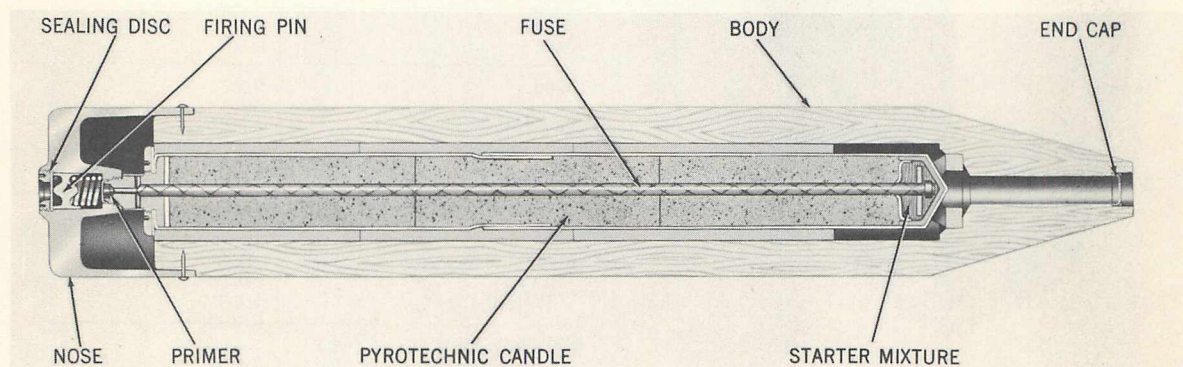


Figure 2.10—Marine Marker Mk 7 Mod 2, Cross Section.



**General.** Marine Marker Mk 7 Mod 2 produces light and smoke and is used as a reference marker. It consists of a die-cast metal nose and a wood body tapered at the tail end. The nose houses the pressure-activated firing pin and primer. The cylindrical wood body contains the pyrotechnic candle and the delay fuse in a round hole through the center. A hole extends through to the tail where it is covered by a metal cap. The delay fuse relays ignition from the primer, through a hole in the center of the candle, to the ignition composition at the tail end of the candle.

**Operation.** The marker is launched by hand, preferably in a horizontal position with the nose forward. It falls nose down, striking the water with enough force to break the sealing disc and drive the firing pin against the primer. The delay fuse burns through the center of the candle, allowing the marker enough time to come to the surface with the tail out of the water. When the ignition composition begins to burn, expanding gases

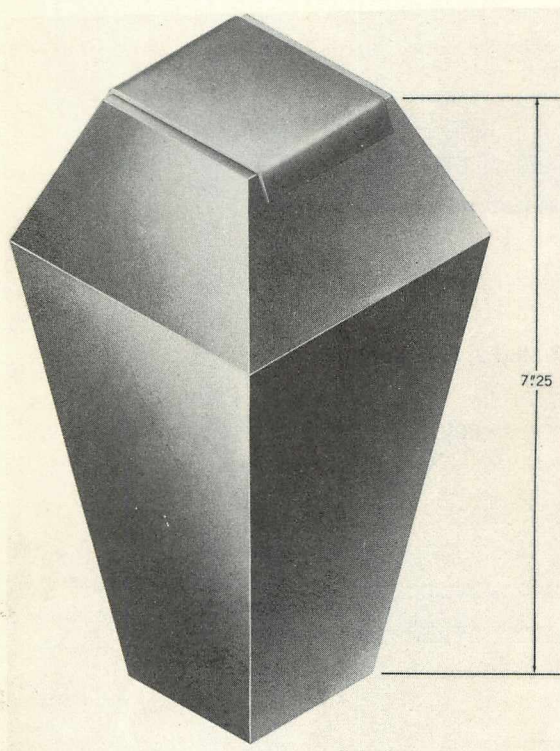


Figure 2.11—Marine Marker Mk 8 Mod 0,  
External View.

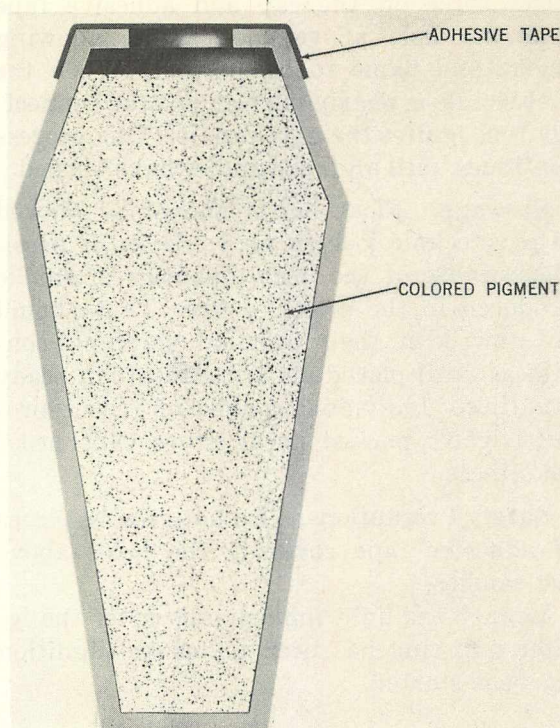


Figure 2.12—Marine Marker Mk 8 Mod 0,  
Cross Section.

force out the cap, and the candle begins to burn with smoke and flame.

**Safety Precautions.** The general safety precautions stated in the first part of this chapter should be observed for this item.

**General.** Marine Marker Mk 8 Mod 0 is used as a reference mark on the surface of

#### Marine Marker MK 8 Mod 0

Mk	8
Mod	0
Drawing No.	1369947
Weight (oz)	31
Color	Chrome yellow
Dye Type Weight (oz)	Stearated chrome yellow 16
Shipping Container Number of Rounds Type Weight (lbs)	6 Fiberboard 48



the water for daylight only. It consists of a ceramic body with a filling hole at the top, covered by adhesive tape. The body is filled with a charge of stearated chrome-yellow pigment.

This marker does not contain an explosive charge.

**Operation.** The marker is launched by being thrown overboard. The fragile body shatters and spreads the pigment, which is not soluble and which produces a slick on the surface of the water.

**Handling and Stowage.** Extreme care must be exercised in the handling and stowage of this item, even when properly packed, because the body is very fragile.

**Safety Precautions.** The general safety precautions stated in the first part of this chapter should be observed for this item.

**General.** Marine Marker Mk 9 Mod 0 produces light and smoke for either day or night marking. The marker consists of a die-cast nose with a funnel-shaped nosepiece, a wood body, and a sheet metal tail. The nose contains a water-pressure activated firing pin and a primer. The body is a wood cylinder with a longitudinal hole through the center, in which are located three pyrotechnic pellets in a moistureproof tube. A delay fuse connects the primer, through a hole in the center of the pellets, to the quickmatch and first-fire

### Marine Marker Mk 9 Mod 0

Mk	9
Mod	0
Drawing No.	1378499
Weight (lb)	3.6
Maximum Release Altitude (ft)	1000
Delay (sec)	8-12
Burning Time (min)	30-35
Flame Color	Yellow
Smoke Color	White
Visibility (miles)	6-7
Shipping Container	8 Wood 60
Number of Rounds	
Type	
Weight (lb)	60

composition at the tail end of the marker. The tail fins are attached to the tapered end of the body. The central hole through the body is capped at the tail end. The tail fins stabilize the marker so that it will strike nose first.

**Operation.** This marker, designed for use from aircraft, is launched by being thrown overboard, preferably in a horizontal position with the nose forward. The funnel-shaped nosepiece increases the water pressure on the sealing disc and permits the marker to be

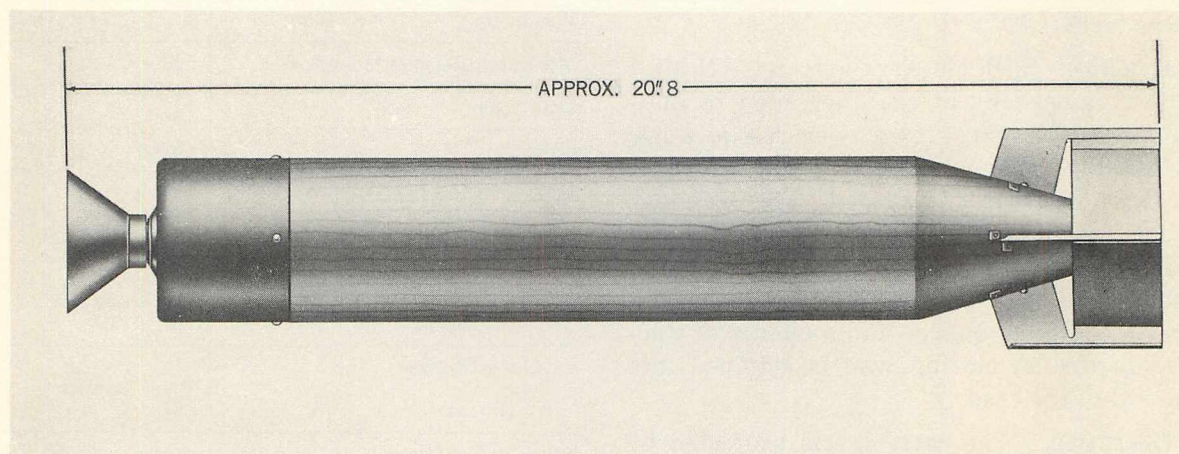


Figure 2.13—Marine Marker Mk 9 Mod 0, External View.



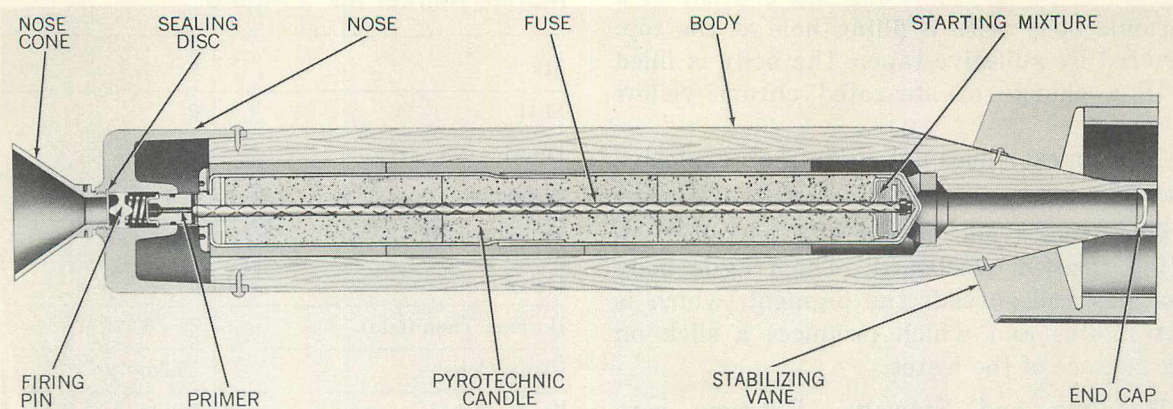


Figure 2.14—Marine Marker Mk 9 Mod 0, Cross Section.

launched at low altitudes. Pending modification of this signal to permit hand launching from surface craft the sealing disc must be ruptured or broken with a sharp instrument prior to launching. When the sealing disc breaks, water pressure forces the firing pin to strike the primer, which ignites the delay fuse. The marker comes to the surface with the tail out of the water while the delay fuse is burning. Flame from the delay fuse causes the pyrotechnic pellets to burn, and the expanding gases force off the cap from the opening of the tail. Smoke and flame are produced.

**Safety Precautions.** Smoking or carrying lighted cigars, cigarettes, or pipes is not permitted in the vicinity of, or while handling, these markers.

**General.** Slick Marker Cartridge AN-Mk 1 Mod 0 is used by aircraft engaged in anti-submarine warfare, for air-sea rescue work, or for any other purpose where a reference mark on the water is needed. The cartridge consists of a shotgun shell type of case and primer. Inside the case is a propelling charge and an aluminum inner case containing an expelling charge and a charge of fluorescein dye. A closing wad is crimped into the end of the case.

**Operation.** The cartridge is projected by Pyrotechnic Pistol AN-M8 from low-flying aircraft. When fired, the primer ignites the propelling charge, the inner case is projected,

and its delay fuse is ignited. The cartridge should not be fired from altitudes greater than 500 feet. If projected from too high an altitude, the inner case will burst in the air and the dye will be spread over too large an area to be effective. If the inner case lands on the water, it floats, and the expelling charge spreads the dye over the surface of the water to form a bright green slick.

#### Slick Marker Cartridge AN-Mk 1 Mod 0

Mk	1
Mod	0
Drawing No.	- 344620
Weight (oz)	4
Maximum Release Altitude (ft)	500
Delay (sec)	11
Color	Green
Dye Type Weight (grams)	Fluorescein 28
Propelling Charge Type Weight (oz)	Black powder .07
Expelling Charges Type Weight (oz)	Black powder .07
Shipping Container Number of Rounds Type Weight (lb)	200 Wood box 83.5



The pistol should be aimed downward and aft to obtain a vertical drop at the time of firing.

**Safety Precautions.** The general safety precautions stated in the first part of this chapter should be observed for this item.

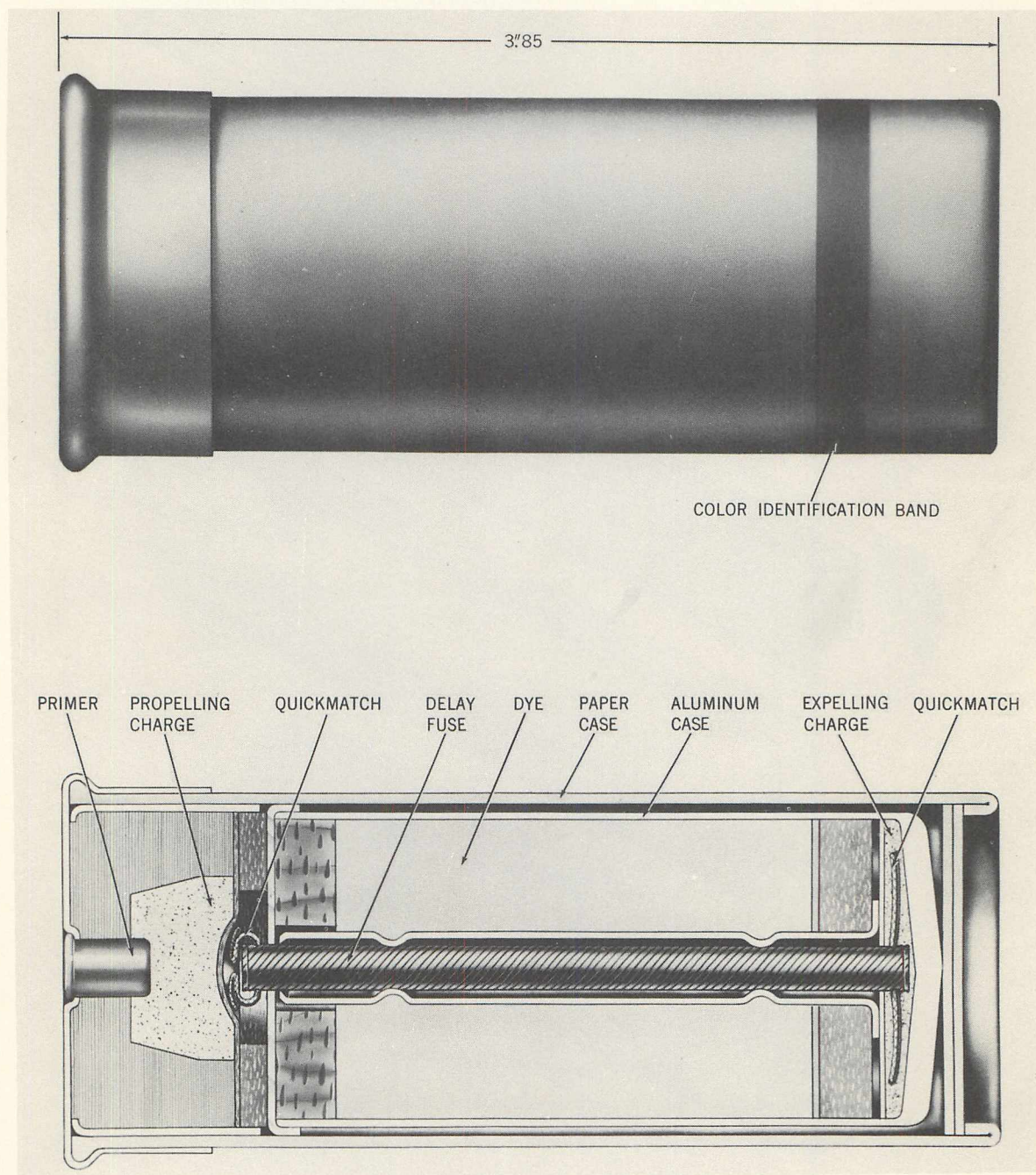


Figure 2.15—Slick Marker Cartridge AN-Mk 1 Mod 0, External View and Cross Section.



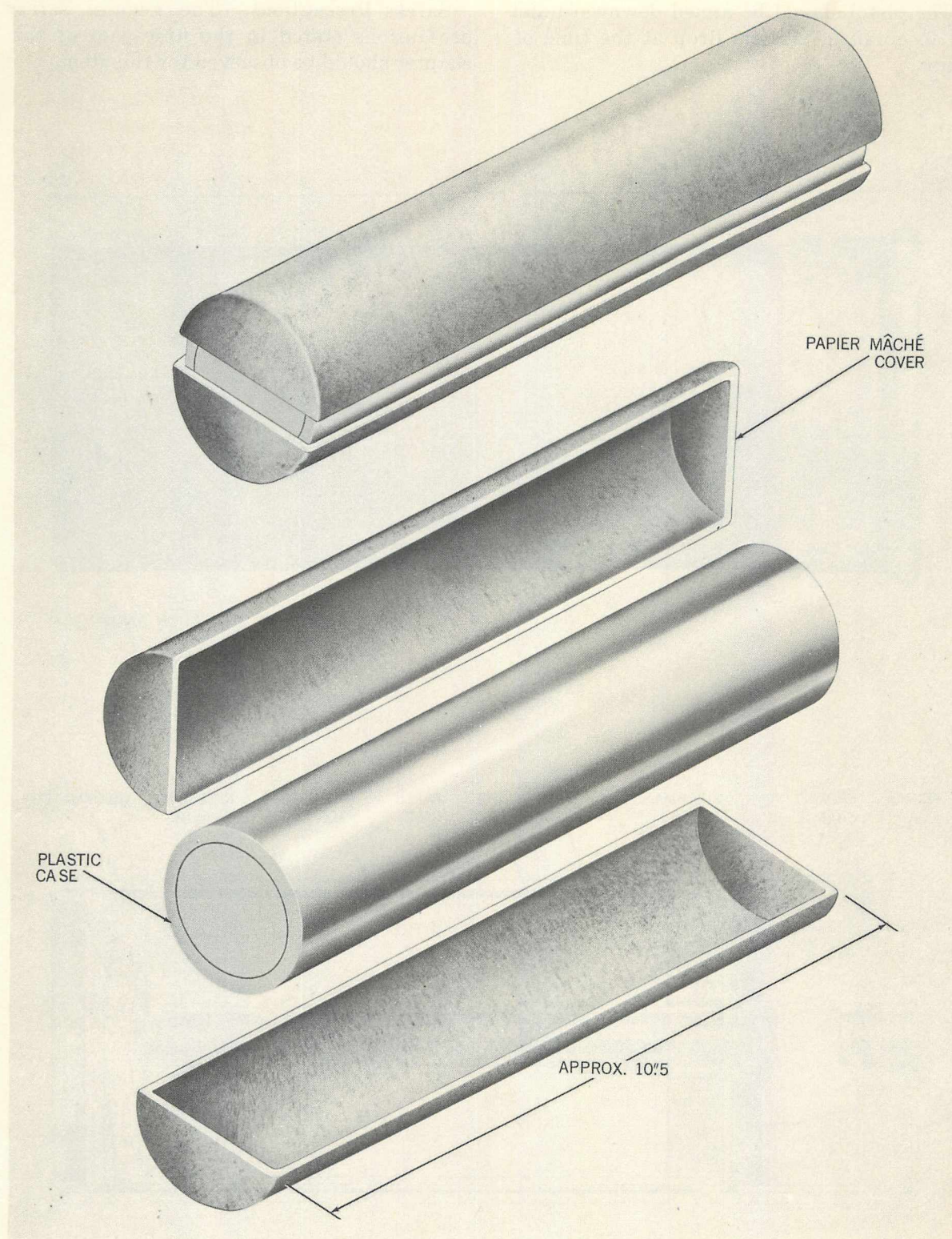


Figure 2.16—Slick Marker AN-M59, External View.



# Slick Marker AN-M59

Model	AN-M59
Drawing No.	78-0-68
Weight (lb)	2.9
Diameter of Plastic Case (in.)	3
Color	Yellow-green
Dye Type Weight (lb)	Uranine 2.2
Shipping Container Number of Rounds Type Weight (lb)	10 Wood box 59

**General.** Slick Marker AN-M59 is for daytime use only. It does not burn, but produces a yellowish green fluorescent slick on the water surface. The slick formed is about

20 feet in diameter, persists for 2 hours, and can be seen at a range of 10 miles from 3000 feet. The marker consists of a molded plastic case filled with a soluble sodium salt of fluorescein (uranine) and is protected by a split papier-mâché cylinder.

An explosive charge is not used with this marker.

**Operation.** The marker is hand-launched from aircraft; during the descent the split outer cover separates and falls away. When the plastic case hits the water it shatters, spreading the dye material, and forms a slick.

**Handling and Stowage.** Since the plastic case is fragile, extreme care must be exercised in the handling and stowage of this item in order to prevent breakage.

**Safety Precautions.** The general safety precautions stated in the first part of this chapter should be observed for this item.

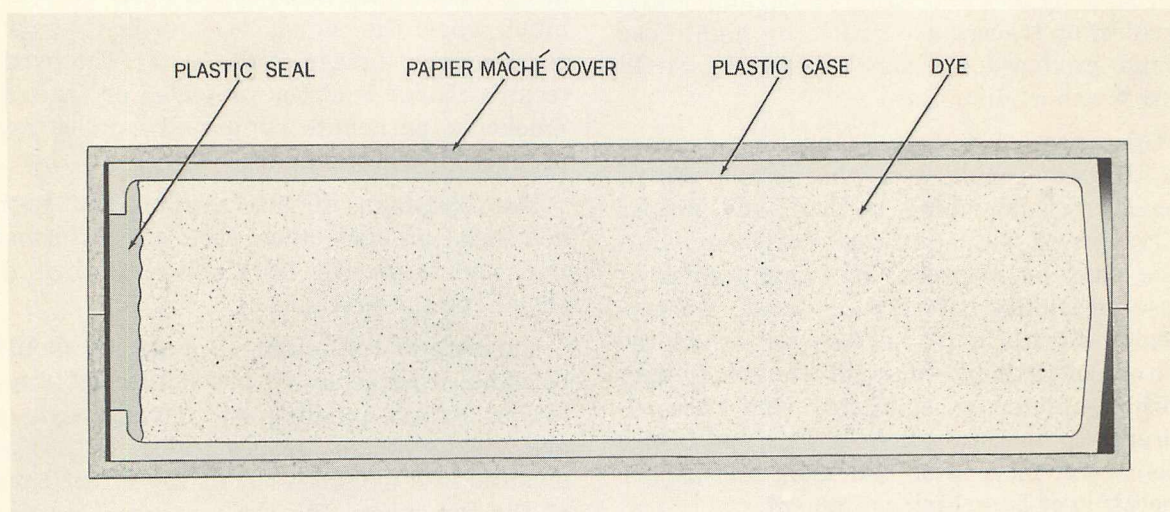


Figure 2.17—Slick Marker AN-M59, Cross Section.



## Chapter 3

### SIGNALS

#### Introduction

Pyrotechnic signals are used for communication or identification between surface craft, surface and aircraft, or submarine to either surface or aircraft. Weather conditions are an important factor in the use of pyrotechnic signals because rain, snow, fog, clouds, and other conditions affect visibility.

Most signals are little larger than shotgun shells, and all are small enough to be stowed easily in small surface craft or submarines. Distress signals are often stowed in pockets of life jackets or in life rafts.

Signals produce a variety of effects. Smoke is visible by day and flame or burning stars, candles, or tracers are visible by night. The sound produced by some signals is useful only for short distances.

**Operation.** Successful launching depends on the serviceability of the signal, use of the correct launching method, and proper operation of the launching equipment. Signals must be inspected for visible signs of unserviceability before being used. Unserviceable signals must be disposed of as the Bureau of Ordnance may direct. Familiarity with the launching equipment and close adherence to operating instructions will insure the correct method of launching and proper operation of launching equipment.

Cartridge-type signals are designed to be launched from specific pistols, and any attempt to launch them by any other means will be hazardous.

The operation of signals varies with the design of the individual item. Signals which are held in the hand while they function are usually ignited by a pull-type igniter or by a method similar to striking a safety match. After ignition, the signal produces flame, smoke, tracers, or projected stars of various colors. The charge may be projected while

burning or it may be contained in a projected case with a propelling charge and a delay charge, which ignites and ejects the pyrotechnic candle. A parachute may be provided to retard the fall of a smoke- or light-producing candle. Some cartridge-type signals are combined with a rocket charge which propels the signal to a much higher altitude than is practical with just the propelling charge in the cartridge case.

Certain signals are projected by air pressure from launchers on submarines. These signals can be launched while the submarine is either submerged or surfaced. A firing mechanism is activated and a delay fuse ignited when the signal is launched. Upon reaching the surface of the water, the pyrotechnic charge is either projected or ignited. Smoke or parachute supported candles are produced by these signals.

**Identification.** Signals are marked with nomenclature and other pertinent information, and frequently have a label listing instructions and precautions.

**Handling and Stowage.** All signals should be handled carefully to prevent possible ignition. Rough handling will damage signals and render them unserviceable. Stowage must be in a dry area out of the direct rays of the sun where the temperature does not exceed 100° F. All signals should be stowed in their shipping containers until they are to be used. Signals removed from containers and not used should be resealed in their original containers. In subsequent firings such items should be used first, so that the stock of open packings may be kept at a minimum.

**Safety Precautions.** Signals which function while being held in the hand should be held at arm's length to leeward at an angle of 30 degrees upward from horizontal. This



will prevent burns caused by hot drippings or discharge.

Pistol-projected signals must be handled as small arms ammunition and must not be pointed toward friendly personnel or craft while being loaded, unloaded, or during projection.

If any cartridge-type signal misfires, make two more attempts to fire the signal, then wait at least 30 seconds before unloading the signal because of the possibility of a hangfire.

Smoking or carrying lighted cigars, cigarettes, or pipes is not permitted in the vicinity of pyrotechnic signals. Matches and other flame-or spark-producing articles should not be carried near places where pyrotechnics are stowed.

Personnel must not look into the top of an aircraft signal of the hand-held type.

Signals stowed aboard an aircraft must be firmly secured to prevent movement which might damage the signal or cause fouling of the controls of the aircraft.

Signals containing primers must be handled carefully to prevent a blow on the primer which might ignite the signal.

When signals with grenade-type firing mechanisms are being launched, the safety lever must be held firmly against the body of the signal while the safety cotter pin is removed and until the signal is launched. The safety cotter pin must not be removed until just before the signal is to be launched.

**General.** Aircraft Red Star Parachute Signal M11 is for use by aircraft in distress. This signal consists of a cylindrical alumi-

### Aircraft Red Star Parachute Signal M11

Model	M11
Drawing No.	78-0-10
Weight (oz)	9.6
Parachute Diameter (ft)	22
Rate of Fall (ft/min)	6
Height of Rise (ft)	150-250
Delay (sec)	2.5
Burning Time (sec)	30
Candlepower	20,000
Color	Red
Visibility (miles)	7-8
Case	Aluminum
Shipping Container	
Number of Rounds	60
Type	Wood box
Weight (lb)	61

num outer case or barrel containing a primer, a propelling charge, and an inner cardboard case. The inner case houses a delay fuze, an expelling charge, a pyrotechnic candle, and a parachute. The outer container has an extraction groove at one end and a metal closing wad at the other. The closing wad has a raised pattern with the letters "RP" (Red Parachute) to facilitate night identification.

**Operation.** Aircraft Parachute Signal M11 is fired from Pyrotechnic Pistol AN-M8. The firing pin of the pistol sets off the primer, which ignites the propelling charge.

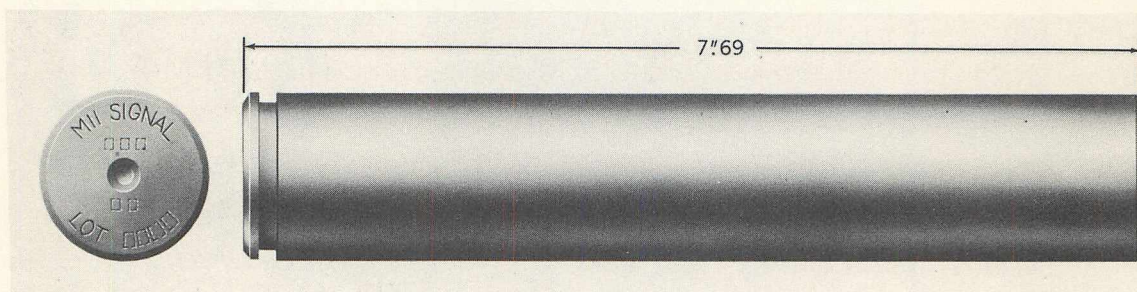


Figure 3.1—Aircraft Red Star Parachute Signal M11, External View.



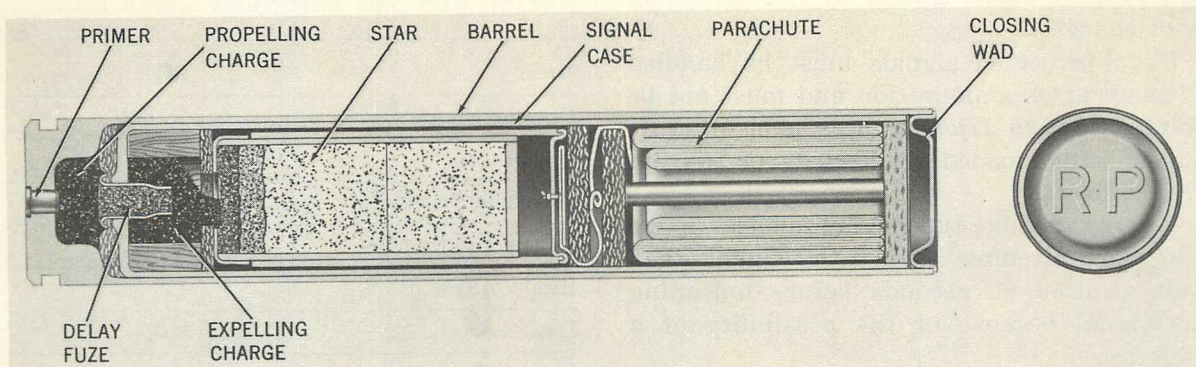


Figure 3.2—Aircraft Red Star Parachute Signal M11, Cross Section.

The propelling charge ignites the delay fuze and propels the inner case outward. The delay fuze burns and ignites the expelling

charge, which in turn ignites the candle and expels the candle and parachute from the inner case.

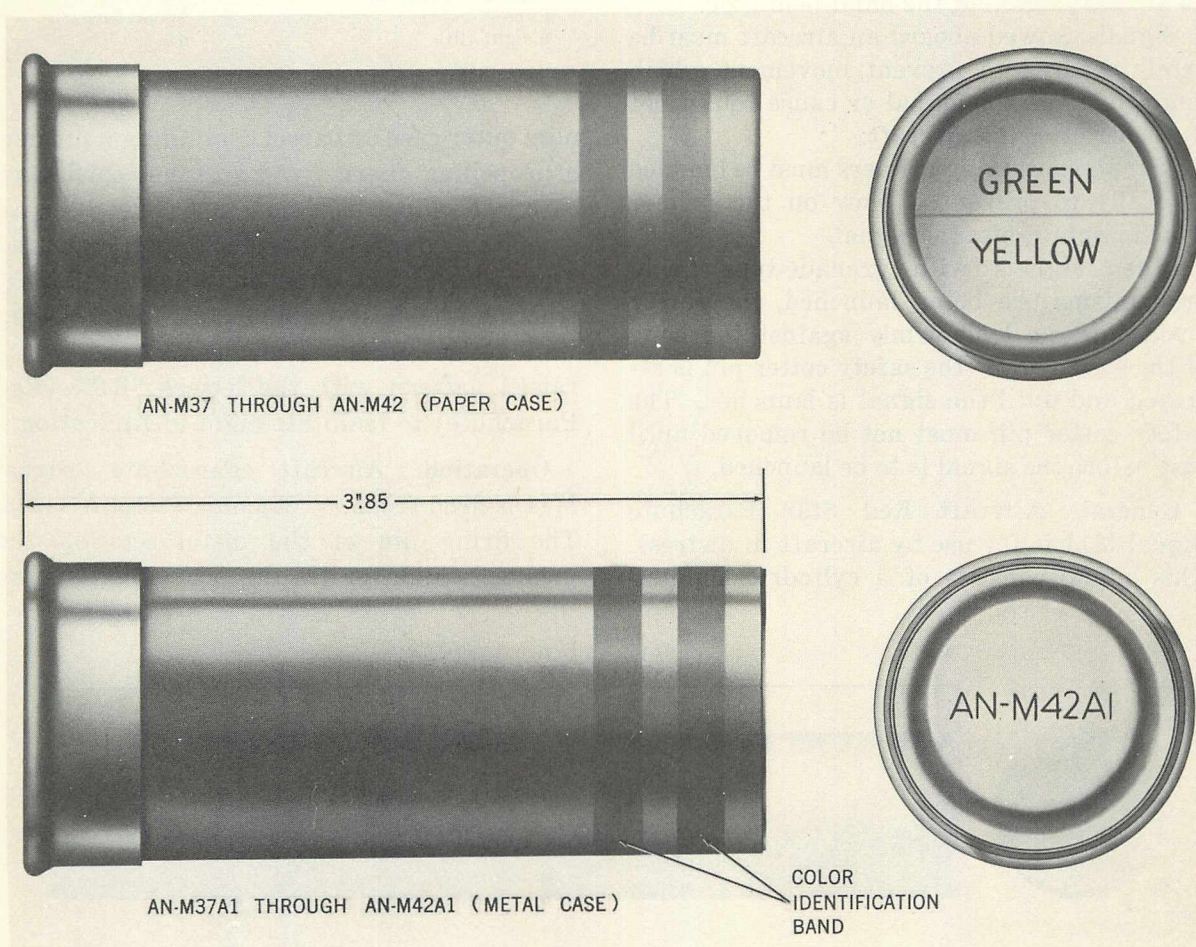


Figure 3.3—Aircraft Double-Star Signals AN-M37 to AN-M42 Series and AN-37A1 to AN-M42A1 Series, External View.



## Aircraft Double-Star Signals AN-M37 to AN-M42 Series and AN-M37A1 to AN-M42A1 Series

Model Shotgun Case Aluminum Case	AN-M37 AN-M37A1	AN-M38 AN-M38A1	AN-M39 AN-M39A1	AN-M40 AN-M40A1	AN-M41 AN-M41A1	AN-M42 AN-M42A1
Drawing No.	78-9-33	78-9-33	78-9-33	78-9-33	78-9-33	78-9-33
Weight (oz)	6	6	6	6	6	6
Delay (sec)	None	None	None	None	None	None
Burning Time (sec)	7	7	7	7	7	7
Candlepower (each star)	25,000	25,000	12,000	20,000	20,000	20,000
Star Type Color	Double Red Red	Double Yellow Yellow	Double Green Green	Double Red Yellow	Double Red Green	Double Green Yellow
Primer	#4	#4	#4	#4	#4	#4
Illuminant weight (lb)	0.21-.24	0.21-.24	0.21-.24	0.21-.24	0.21-.24	0.21-.24
Propelling Charge Type Weight (oz)	Black powder 0.08	Black powder 0.08	Black powder 0.08	Black powder 0.08	Black powder 0.08	Black powder 0.08
Shipping Container Number of Rounds Type Weight (lb)	144-80 Wood box 98-57	144-80 Wood box 98-57	144-80 Wood box 98-57	144-80 Wood box 98-57	144-80 Wood box 98-57	144-80 Wood box 98-57

**General.** Aircraft Double-Star Signals AN-M37 to AN-M42 series and AN-M37A1 to AN-M42A1 series are used for identification or signaling during the day or night. Each signal projects two stars of the same color or different colors. Both series are similar in construction, use, and launching. The signals of the AN-M37 to AN-M42 series have paper cases and are similar to large shotgun shells. The signals of the AN-M37A1 to AN-M42A1 series have aluminum cases.

**Operation.** The signals have rimmed bases to fit the ejector of a pyrotechnic pistol, currently Pyrotechnic Pistol AN-M8, which is used to launch them. A signal begins to function when the firing pin of the pistol strikes the primer of the signal. The primer ignites the propelling charge, the stars are projected, and the quickmatch is ignited at the same time. The quickmatch ignites the stars. When the cartridge is fired from the surface, the stars reach full brilliance at a height of about 50 feet and continue to rise to an altitude of 250 feet. Under these circumstances the

stars are visible for about 2 to 3 miles in the daytime, and 5 miles at night.

**Identification.** The signals can be identified by colored bands  $\frac{1}{4}$ -inch wide on the case, the same color as the stars. The paper case signals also have a closing wad of the same color as the stars. There is no provision for identification of color by touch.

**General.** Aircraft Single-Star Signals AN-M43 to AN-M45 series and AN-M43A1 to AN-M45A1 series are used for identification or signaling during the day or night. Each signal projects one star of a designated color. Both series are similar in construction, use, and launching. The signals of the AN-M43 to AN-M45 series have paper cases and are similar to large shotgun shells. The AN-M43A1 to AN-M45A1 series signals have aluminum cases.

**Operation.** The signals have rimmed bases to fit the ejector of a pyrotechnic pistol, currently Pyrotechnic Pistol AN-M8, which is used to launch them. A signal begins to



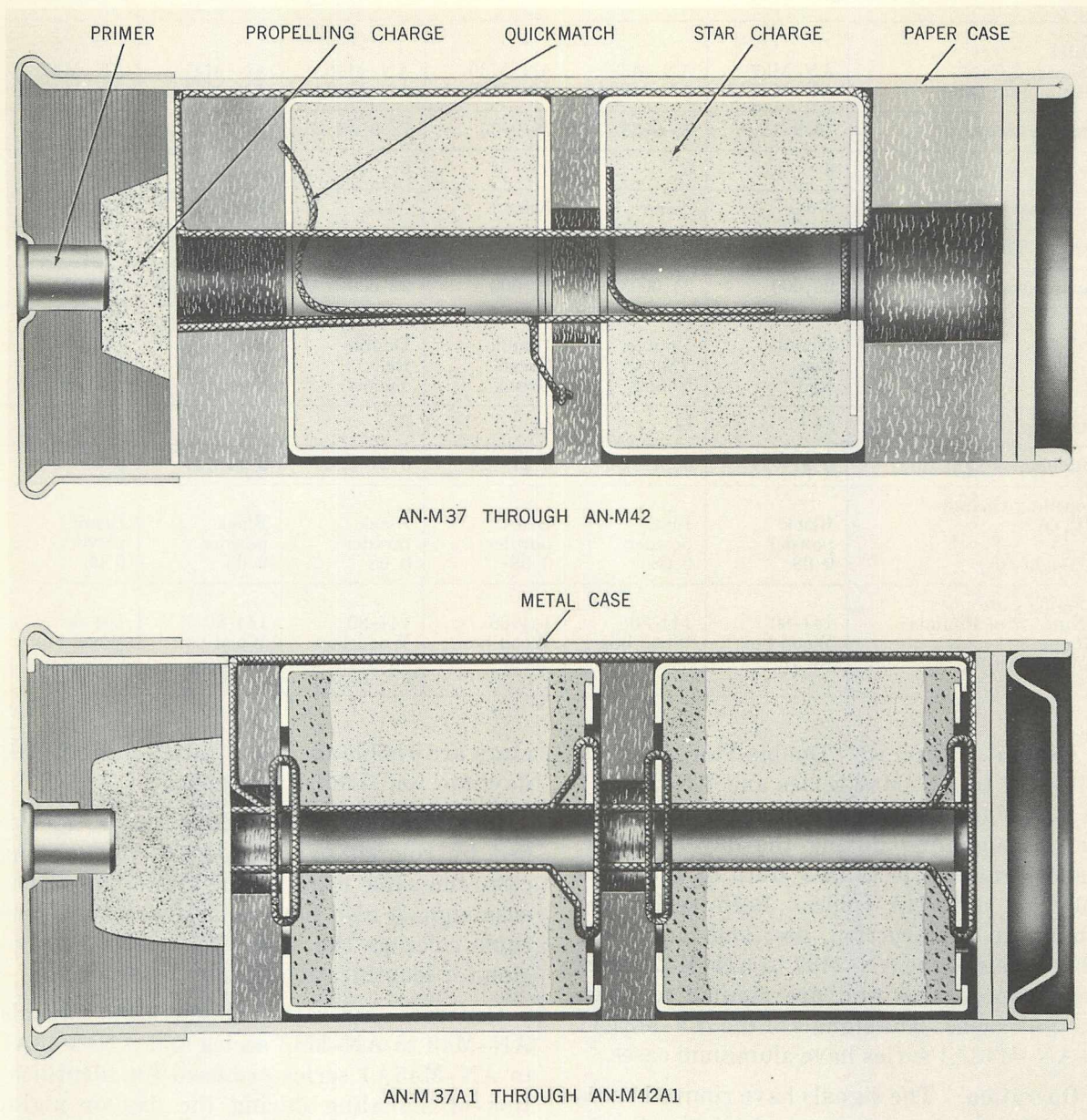


Figure 3.4—Aircraft Double-Star Signals AN-M37 to AN-M42 Series and AN-M37A1 to AN-M42A1 Series, Cross Section.

Aircraft Single-Star Signals AN-M43 to AN-M45 Series and AN-M43A1 to AN-M45A1 Series

Model Shotgun Case Aluminum Case	AN-M43 AN-M43A1	AN-M44 AN-M44A1	AN-M45 AN-M45A1
Drawing No.	78-0-34	78-0-34	78-0-34
Weight (oz)	4.3	4.17	5.14



Delay (sec)	None	None	None
Burning Time (sec)	7	7	7
Candlepower (each star)	25,000	15,000	30,000
Star Type Color	Single Red	Single Yellow	Single Green
Primer	#4	#4	#4
Illuminant Weight (oz)	2.23	2.10	3.08
Propelling Charge Type Weight (oz)	Black powder 0.08	Black powder 0.08	Black powder 0.08
Shipping Container Number of Rounds Type Weight (lb)	144-72 Wood box 83-43	144-72 Wood box 83-43	144-72 Wood box 83-43

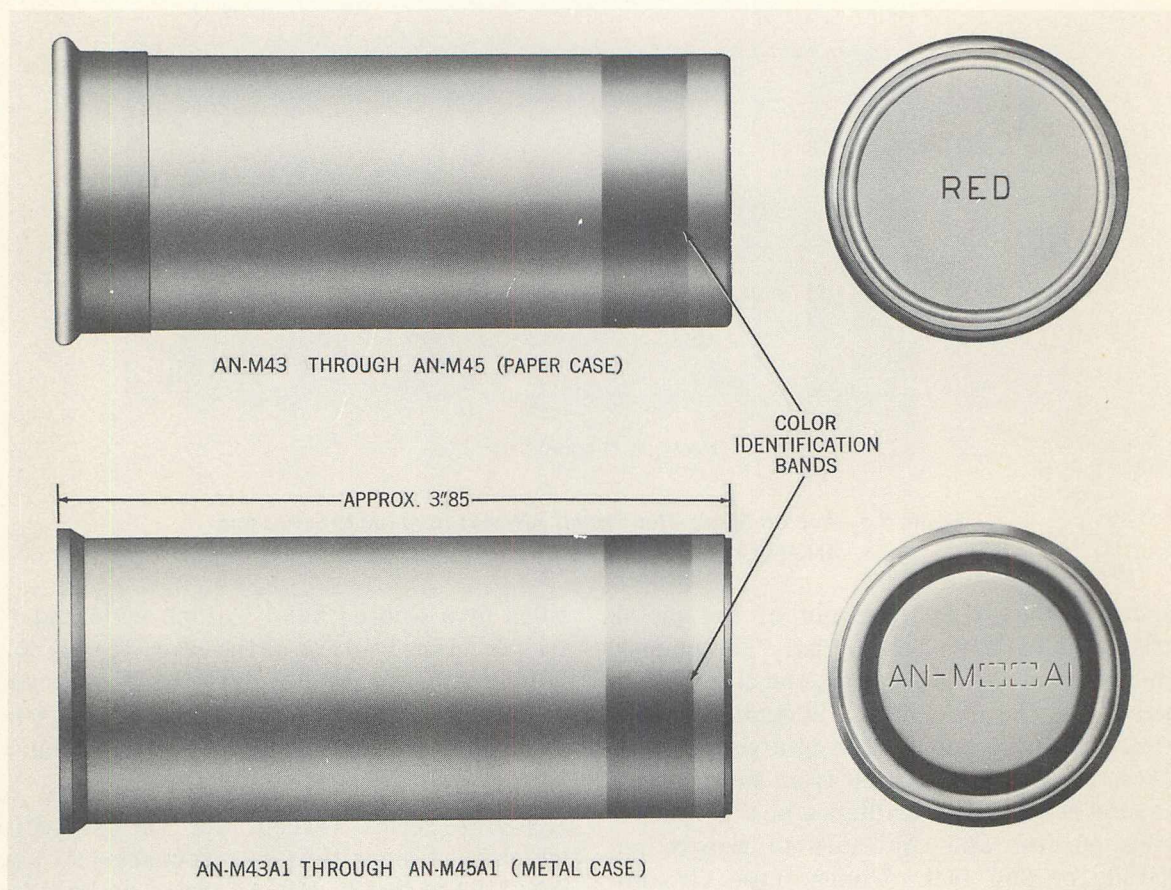


Figure 3.5—Aircraft Single-Star Signals AN-M43 to AN-M45 Series and AN-M43A1 to AN-M45A1 Series, External View.



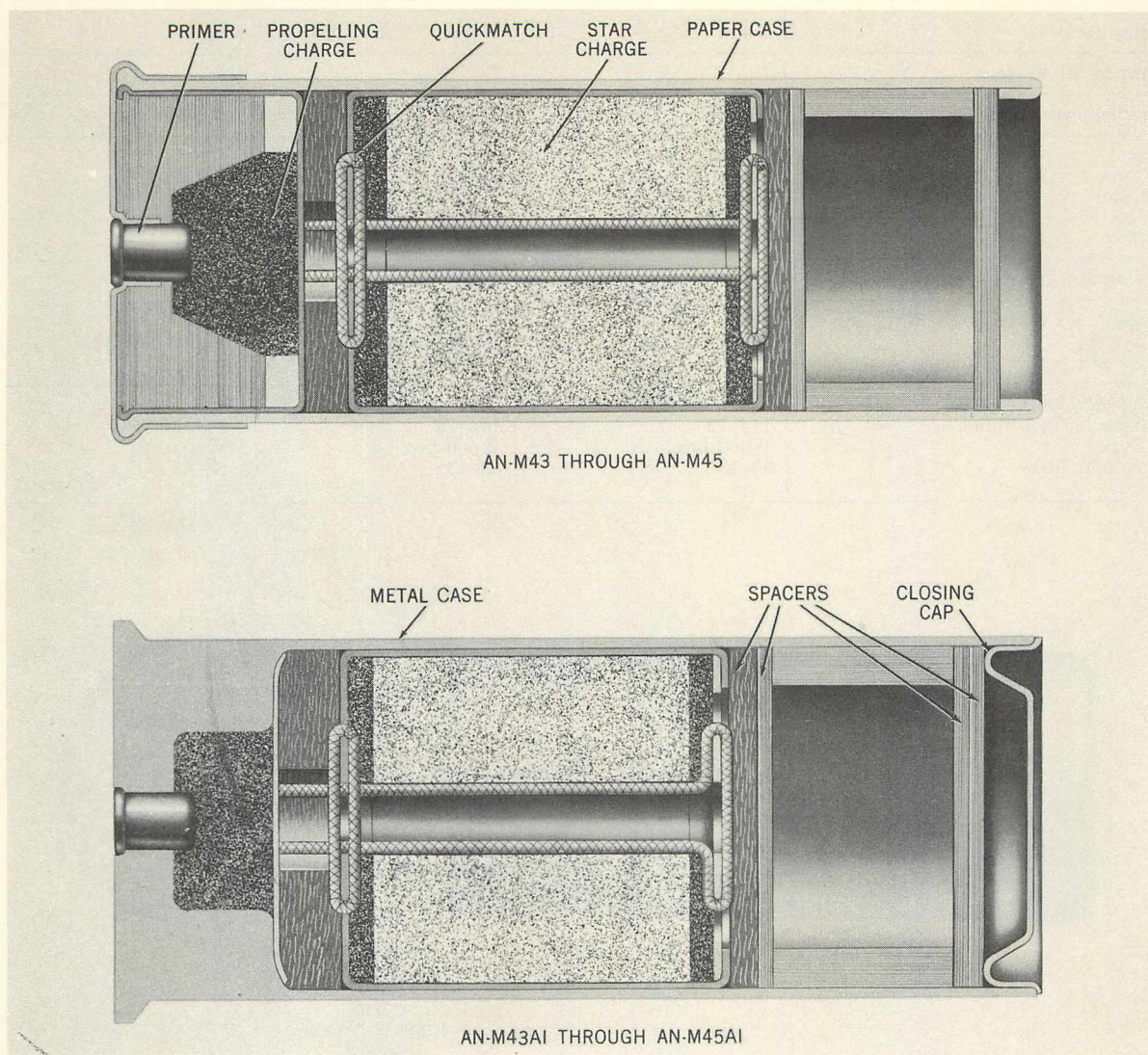


Figure 3.6—Aircraft Single-Star Signals AN-M43 to AN-M45 Series and AN-M43A1 to AN-M45A1 Series, Cross Section.

function when the firing pin of the pistol strikes the primer of the signal. The primer ignites the propelling charge, the star is projected, and the quickmatch is ignited at the same time. The quickmatch ignites the star. When the cartridge is fired from the surface, the star reaches full brilliance at a height of about 50 feet and continues to rise to an altitude of 250 feet. Under these circumstances the star is visible for about 2 to 3 miles in the daytime, and 5 miles at night.

**Identification.** These signals can be iden-

tified by a colored band  $\frac{1}{2}$ -inch wide and  $\frac{1}{4}$  inch from the wad end of the case. The signals having paper cases also have the closing wad of the same color as the star. There is no provision for identification of color by touch.

**General.** Aircraft Signals AN-M53 to AN-M58 series (except for the AN-M54 which has been withdrawn from service) and AN-M53A1 to AN-M58A1 series are used for identification or signaling during the day or night. Each signal projects a colored tracer and two colored stars.



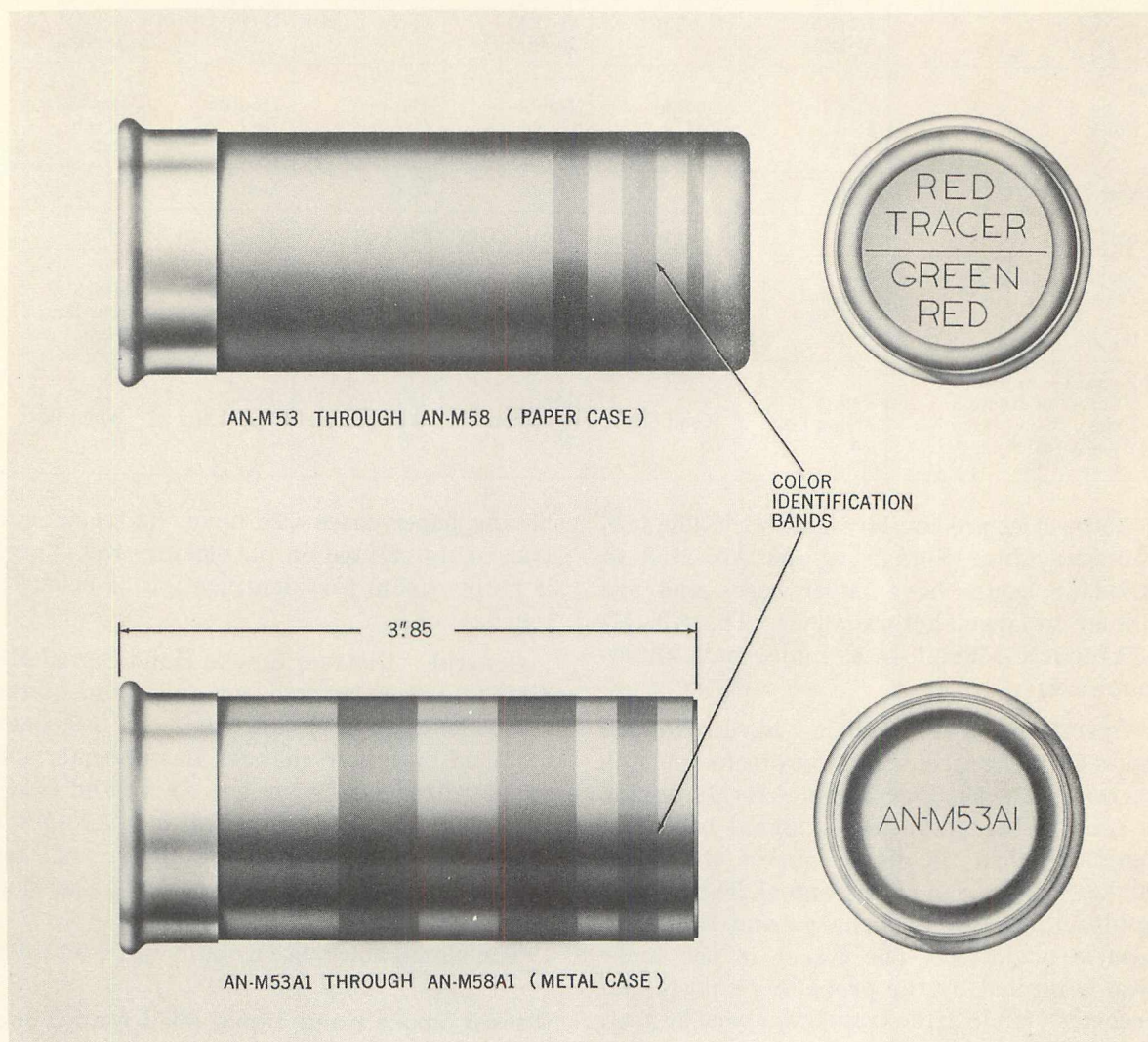


Figure 3.7—Aircraft Signals AN-M53 to AN-M58 Series and AN-M53A1 to AN-M58A1 Series, External View.

#### Aircraft Signals AN-M53 to AN-M58 Series and AN-M53A1 to AN-M58A1 Series

Model Shotgun Case Aluminum Case	AN-M53 AN-M53A1	AN-M54A1	AN-M55 AN-M55A1	AN-M56 AN-M56A1	AN-M57 AN-M57A1	AN-M58 AN-M58A1
Drawing No.	78-0-64	78-0-64	78-0-64	78-0-64	78-0-64	78-0-64
Weight (oz)	4-6	4-6	4-6	4-6	4-6	4-6
Delay (sec)	4	4	4	4	4	4
Burning Time (sec) Tracer Star	2.5-4 3-4.5	2.5-4 3-4.5	2.5-4 3-4.5	2.5-4 3-4.5	2.5-4 3-4.5	2.5-4 3-4.5



Candlepower (each star)	T-30M R-48M Y-36M	T-25M R-48M (ea.)	T-25M G-20M R-48M	T-30M G-20M (ea.)	T-30M R-48M (ea.)	T-30M G-20M R-48M
Star Type Color	Double Red Yellow	Double Red Red	Double Green Red	Double Green Green	Double Red Red	Double Green Red
Tracer Color	Yellow	Green	Green	Red	Red	Red
Primer	#4	#4	#4	#4	#4	#4
Propelling Charge Type Weight (oz)	Black powder 0.08	Black powder 0.08	Black powder 0.08	Black powder 0.08	Black powder 0.08	Black powder 0.08
Shipping Container Number of Rounds Type Weight (lb)	144 Wood box 75	144 Wood box 75	144 Wood box 75	144 Wood box 75	144 Wood box 75	144 Wood box 75

Both series are similar in construction, use, and launching. Signals of the AN-M53 to AN-M58 series have paper cases and are similar to large shotgun shells. The AN-M-53A1 to AN-M58A1 series signals have aluminum cases.

**Operation.** The signals have rimmed bases to fit the ejector of a pyrotechnic pistol, currently Pyrotechnic Pistol AN-M8, which is used to launch them. A signal begins to function when the firing pin of the pistol strikes the primer of the signal. The primer ignites the propelling charge and the inner case is projected. The tracer in the inner case is ignited by the propelling charge and becomes visible after traveling about 20 feet. It continues to burn until the inner case reaches its full height of travel. A relay charge from the tracer ignites quickmatch running through the stars and the star ejection charge. The burning stars are ejected from the inner case. When fired from the surface, the stars rise to an altitude of 250 feet. Under these circumstances the stars are visible for about 2 to 3 miles in the daytime, and 5 miles at night.

**Identification.** These signals can be identified by the three colored bands on the case. A 1/4-inch band next to the closing wad identifies the color of the tracer. The two 1/2-inch colored bands toward the base of the case identify the color of the stars. The signals

having paper cases also have the tracer and star colors printed on the closing wad. There is no provision for identification of color by touch.

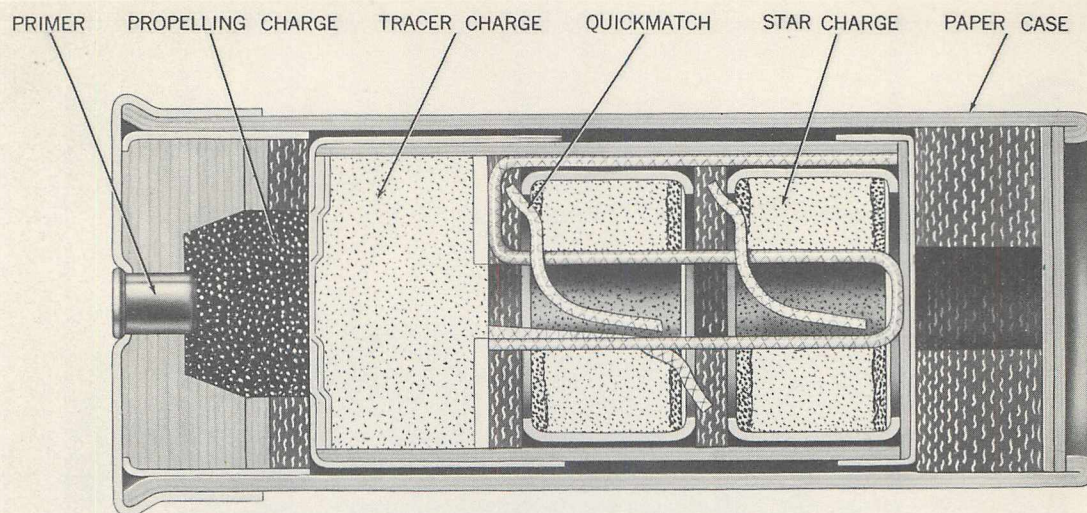
**General.** Distress Smoke Hand Signal Mk 1 Mod 0 is for daytime use, and is one of the components of life-raft kits. It has been modified by minor changes in materials and standardized jointly by the Army and Navy as Signal, Distress, Smoke, Hand, AN-Mk 1 Mod 1. A brass wire in the Mod 1 replaces the steel wire in the Mod 0 to make the Mod 1 less subject to accidental ignition.

The signal consists of one metal container

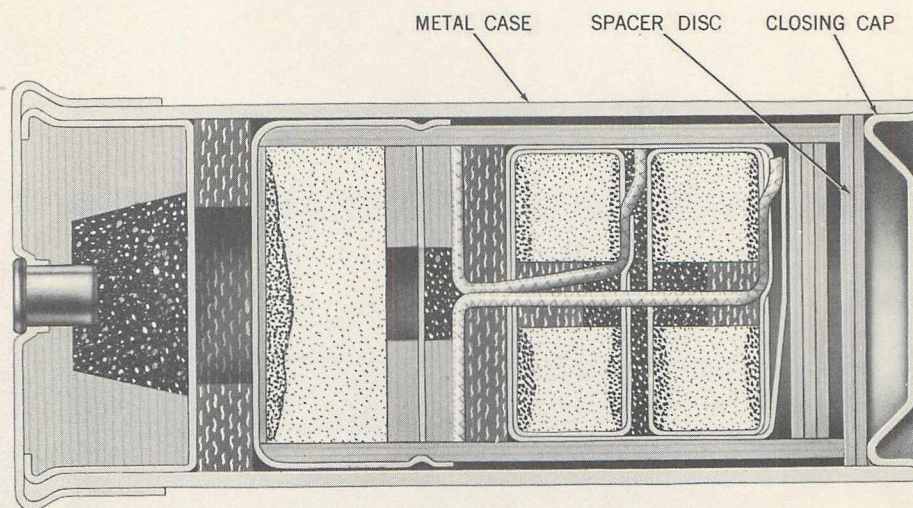
#### Distress Smoke Hand Signal Mk 1 Mod 0 and AN-Mk 1 Mod 1

Mk	1	AN-Mk 1
Mod	0	1
Drawing No.	398760	398760
Weight (oz)	5.92	6.08
Delay (sec)	0	0
Burning Time (sec)	18	18
Color	Orange	Orange
Smoke Mixture (oz)	2.12	2.12
Shipping Container Number of Rounds Type Weight (lb)	100 Wood box 55	100 Wood box 55





AN-M 53 THROUGH AN-M 58 ( PAPER CASE )



AN-M 53A1 THROUGH AN-M 58A1 ( METAL CASE )

Figure 3.8—Aircraft Signals AN-M53 to AN-M58 Series and AN-M53A1 to AN-M58A1 Series, Cross Section.



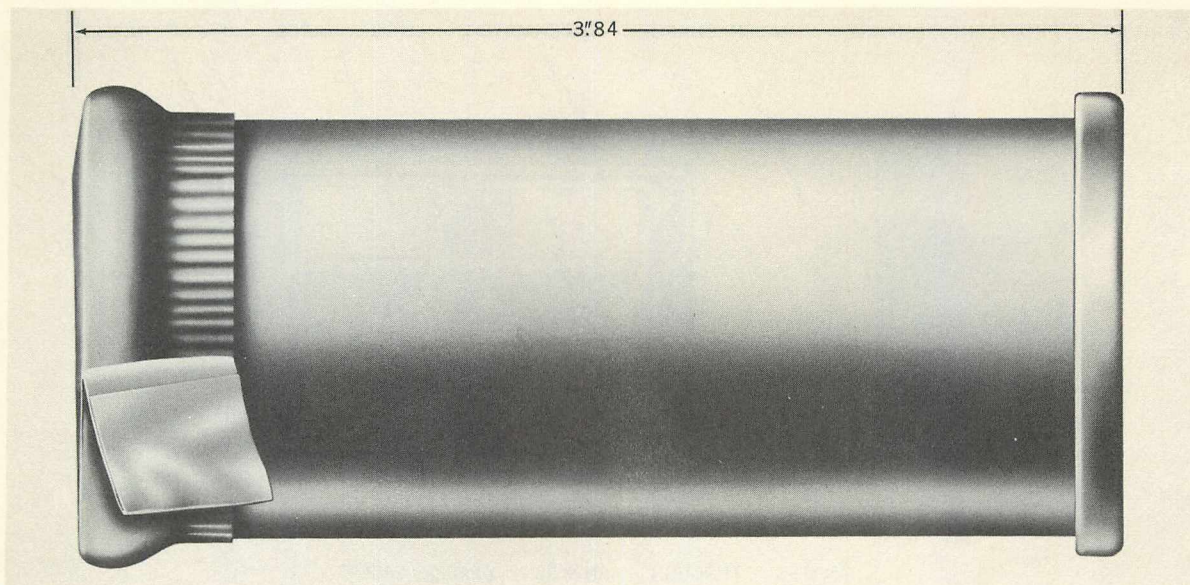


Figure 3.9—Distress Smoke Hand Signal AN-Mk 1 Mod 1, External View.

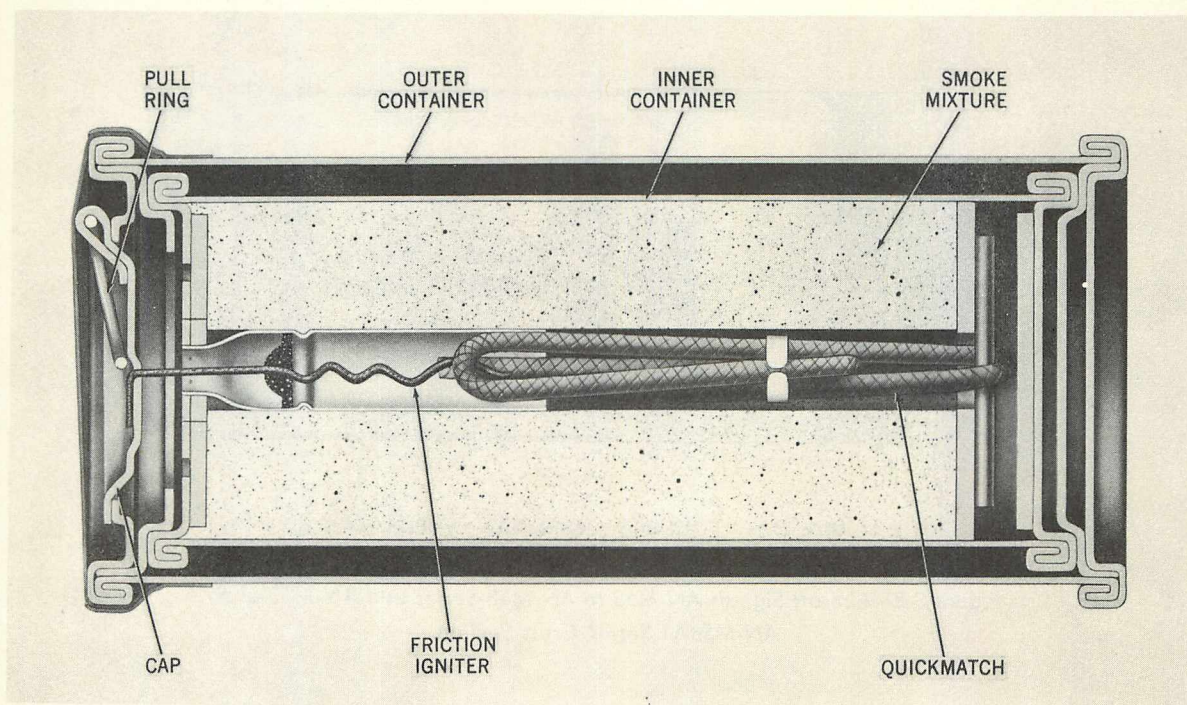


Figure 3.10—Distress Smoke Hand Signal AN-Mk 1 Mod 1, Cross Section.



inside another so that the outer container does not become hot when the signal functions and can, therefore, be held in the hand. One end is closed by a soldered cap. A pull ring large enough for insertion of the index finger is secured to this cap. A friction igniter attached to the inner side of the soldered cap causes ignition of the smoke mixture.

**Operation.** To operate the signal, proceed as follows.

1. Tear off the sealing tape from around the end of the cylinder and remove the paper cap.

2. Point the cylinder away from the face and give a quick pull on the pull ring. The cap will come away from the can and smoke will be emitted immediately.

3. Hold the signal to leeward at arm's length at an angle of about 30 degrees upward from the horizontal to prevent hot drippings from falling on the hand.

**Handling and Stowage.** Signals should not be handled roughly. Stow in a cool dry place where the temperature will never exceed 100° F. These signals may be stowed with other types of pyrotechnic ammunition. The signal is watertight and, accordingly, is not affected by water.

**Safety Precautions.** The general safety precautions noted in the first part of this chapter should be observed. Care should be

taken to hold the signal properly to prevent drippings from hitting the hand.

#### Day and Night Distress Signal Mk 13 Mod 0

Mk	13
Mod	0
Drawing No.	712793
Weight (oz)	6.4
Delay	0
Burning Time (sec)	18
Flame	18-20
Smoke	
Candlepower	3000
Color	Red
Flame	Orange
Smoke	
Shipping Container	100 12
Number of Rounds	Wood Metal
Type	box can
Weight (lb)	55 8

**General.** Day and Night Distress Signal Mk 13 Mod 0 is a combination distress signal for either day or night use. Because of its small size and light weight, it can be carried in the pockets of life vests or flight suits and on life rafts. This signal is especially adapted for use by aircraft personnel downed at sea.

The signal consists of a metal cylindrical outer case with each end closed by a soldered

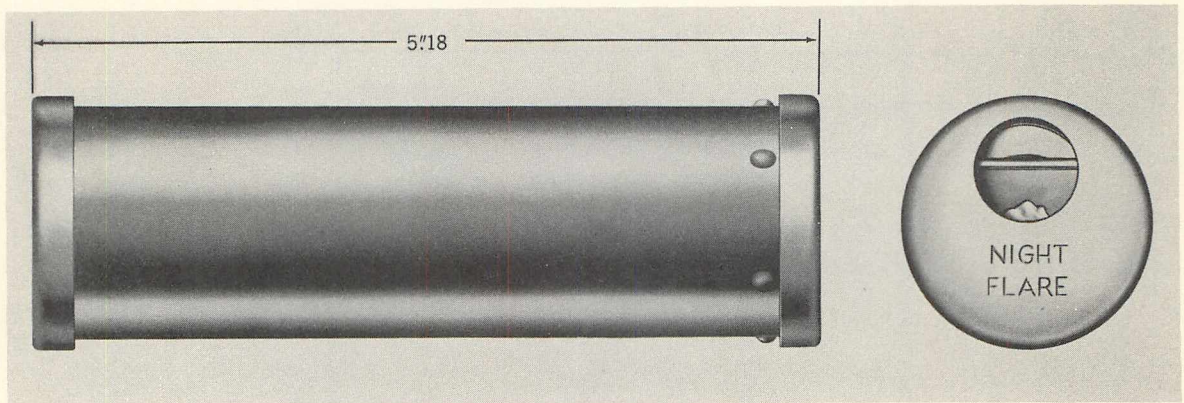


Figure 3.11—Day and Night Distress Signal Mk 13 Mod 0, External View.



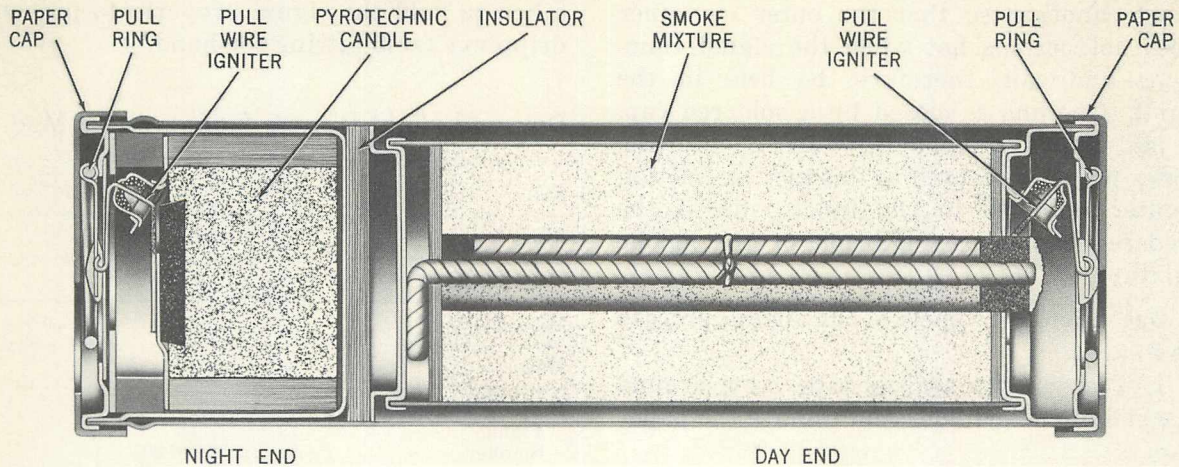


Figure 3.12—Day and Night Distress Signal Mk 13 Mod 0, Cross Section.

cap; each cap has an attached pull ring large enough for the insertion of the index finger. The signal has two inner cans, one containing an orange smoke pyrotechnic, and the other a flare pyrotechnic. A brass pull wire is attached to the bottom of each cap through an ignition cap. Both ends of the signal are covered by paper caps to prevent the metal caps from being pulled off accidentally.

Instructions for using the signal are printed on the cylindrical outer case. The flare end of the signal (for night use) has raised projections extending around the body about  $\frac{1}{4}$  inch from the cap. These serve as an identification so that the signal can be correctly operated, even in total darkness.

When the "day" end is used, orange smoke is emitted and when the "night" end is used a pyrotechnic candle is lighted. Each section of the signal is waterproofed and each section is heat-insulated from the other. The signal is designed to be held comfortably in the bare hand while it is functioning.

**Operation.** To operate the signal, proceed as follows.

1. Determine which end of the signal to use. Remove the paper cap which is glued to the signal body.
2. Point the signal away from the face and give a quick pull on the pull ring. The cap will come away from the can and ignite the composition. It may be necessary to bring

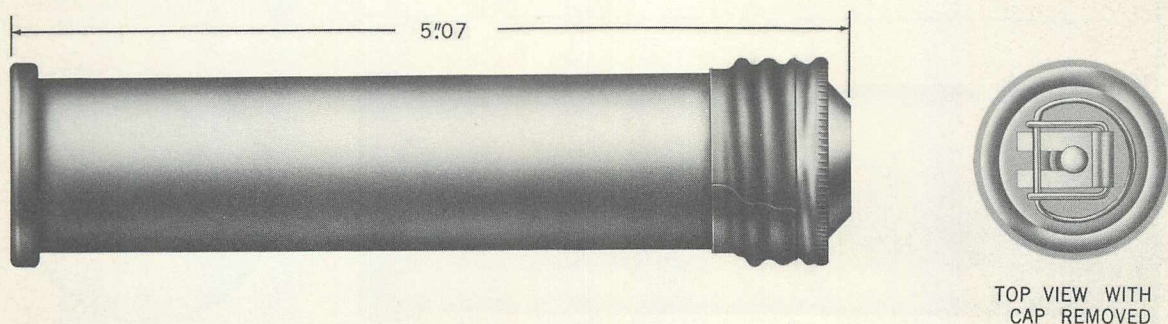


Figure 3.13—Distress Signal AN-M75, External View.



the pull ring down over the rim of the can, and to twist it to break the seal.

3. Douse the signal in water immediately after use in order to cool the metal parts. The signal should then be retained for use of the opposite end, if required.

**Safety Precautions.** The following are special safety precautions applicable to this signal.

Never attempt to ignite both ends of the signal at the same time.

Do not handle the signal roughly.

Hold the signal properly to prevent drippings from hitting the hand.

**General.** Distress Signal AN-M75 is an emergency rescue signal small enough to be carried in the pockets of life vests or flight suits and on life rafts.

The signal consists of an outer case of water-proof construction which is insulated from the inner case. The outer case, except for the metal cap, is painted red. The inner case contains two pyrotechnic stars which are projected by ejection charges, with an igniter consisting of a spring-loaded firing pin and a primer. The firing pin is held in the cocked position by the retaining fork. A two-piece firing linkage connects the retaining fork to the firing ring.

When the firing ring is pulled, the retain-

### Distress Signal AN-M75

Model	AN-M75
Drawing No.	78-0-82
Weight (oz)	5.5
Height of Rise (ft)	100-200
Delay (sec)	2-4
Burning Time (sec)	4-6 per star
Candlepower	8000 per star
Star Type Color	Double Red
Primer	M27
Ejection Charge Type Weight (grains)	Black powder 11.4
Shipping Container Number of Rounds Type Weight (lb)	100 Wood box 57

ing fork releases the spring-loaded striker which then ignites the primer. The igniter assembly is thereupon thrown about 10 feet from the signal, and the first delay charge is ignited. This charge burns 2 to 4 seconds before igniting the first expelling charge for the first star. Firing of the first expelling charge ignites the second delay charge, which burns for 2 to 4 seconds and then ignites the

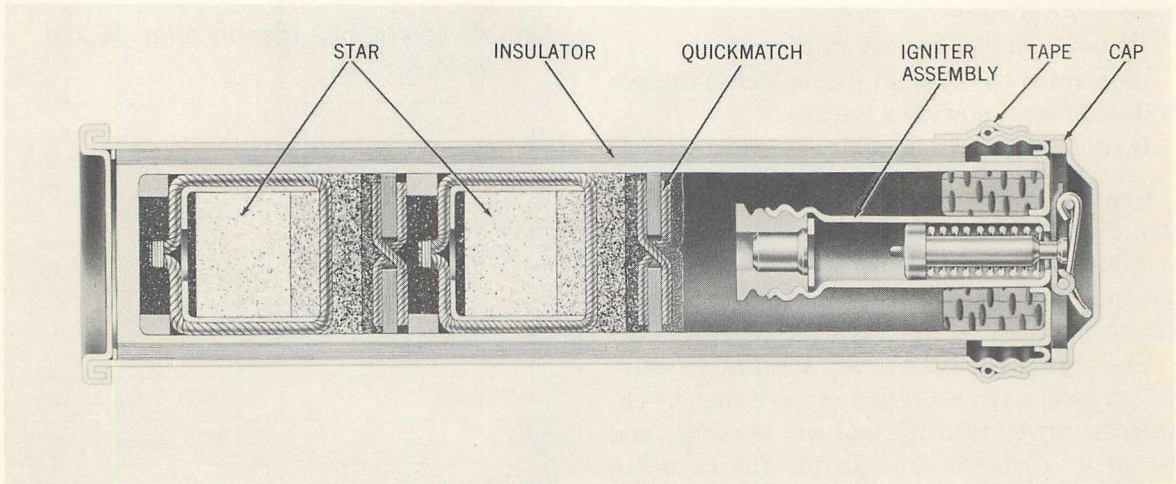


Figure 3.14—Distress Signal AN-M75, Cross Section.



second expelling charge, which expels the second star. Each star burns for 4 to 6 seconds.

**Operation.** To operate the signal, proceed as follows.

1. Open the moisture-resistant transparent bag containing the signal just before the signal is to be fired. Opening the bag is easier if a small nick is bitten into the bag to start the tear.

2. Remove the sealing tape.

3. Unscrew the closing cap.

4. Hold the signal firmly in one hand, with the top pointing upward, to leeward, away from the body.

5. Unfold and fully extend the pull ring and pull or twist it sharply to disengage the release fork.

6. Continue to hold the signal upward, pointed away from the body and face. When the signal has fired both stars, or if more than 6 seconds have elapsed after the firing of the first star without ejection of the second star, throw the signal overboard.

**Stowage.** Stow signals in a cool, dry place, the temperature of which should never exceed 100° F.

**Safety Precautions.** In addition to the general precautions outlined in the first section of this chapter, observe the following.

Do not handle signals roughly.

Point the ignition end of the signal up and away from the face.

Do not look into the top of the signal.

Remember that the igniter holder is thrown 10 feet after the primer ignites.

Do not attempt to investigate malfunctions.

**General.** Aircraft Emergency Identification Signals Mk 6 Mod 0 are used as a means of night identification for aircraft. The signals produce red, white, or green stars which are parachute suspended.

The signal consists of an aluminum cylindrical case, with a grenade-type firing mechanism screwed into one end and the other end closed by a metal cap. Inside the case are the ejection charge, the pyrotechnic star charge, and a parachute which is made of silk, rayon, or paper.

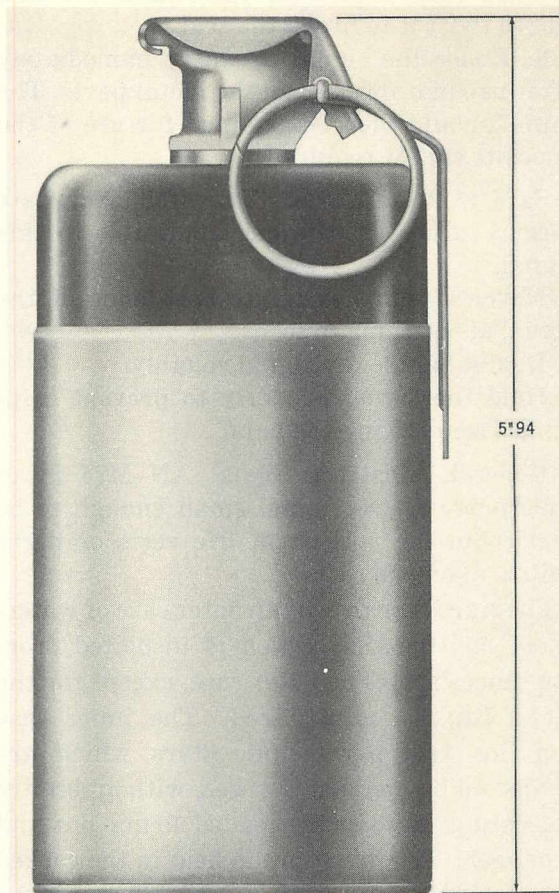


Figure 3.15—Aircraft Emergency Identification Signal Mk 6 Mod 0, External View.

#### Aircraft Emergency Identification Signal Mk 6 Mod 0

Mk	6
Mod	0
Drawing No.	233406
Weight (lb)	1-1.17
Delay (sec)	3
Burning Time (sec)	25
Candlepower	2400, 1500, 27,000
Color	Red, green, white
Visibility (miles)	8-10
Illuminant (oz)	4.24, 5.29, 5.83
Primer	#4



Ejection Charge Type Weight (oz)	Black powder 0.039
Shipping Container Number of Rounds Type Weight (lb)	12 Wood box 27

**Operation.** After selecting the star color to be used, the signal is launched by being grasped in one hand with the safety lever held firmly against the body of the signal. The safety ring, which is attached to the safety cotter pin, is pulled with the other hand, or may be pulled by catching it on a stationary hook located inside the aircraft. The signal is then thrown overboard.

When the safety lever is released, it is

thrown off by the spring-loaded striker which rotates and strikes the primer. The delay element is ignited by the primer and, in turn, the ejection charge is ignited. Expanding gases eject the parachute and pyrotechnic star by pushing off the closing cap. The star is ignited by quickmatch which is ignited by the ejection charge. The parachute opens and suspends the burning star.

**Identification.** The closing cap has a raised pattern to aid in night identification of the star color. The red-star signal has a dot, the white-star signal has a short, straight line, while the green-star signal has a wide V in the middle of the cap. All three have a raised curved line 1 inch in length near the edge of the cap. The outer surface of the signal is stenciled to indicate the color of the

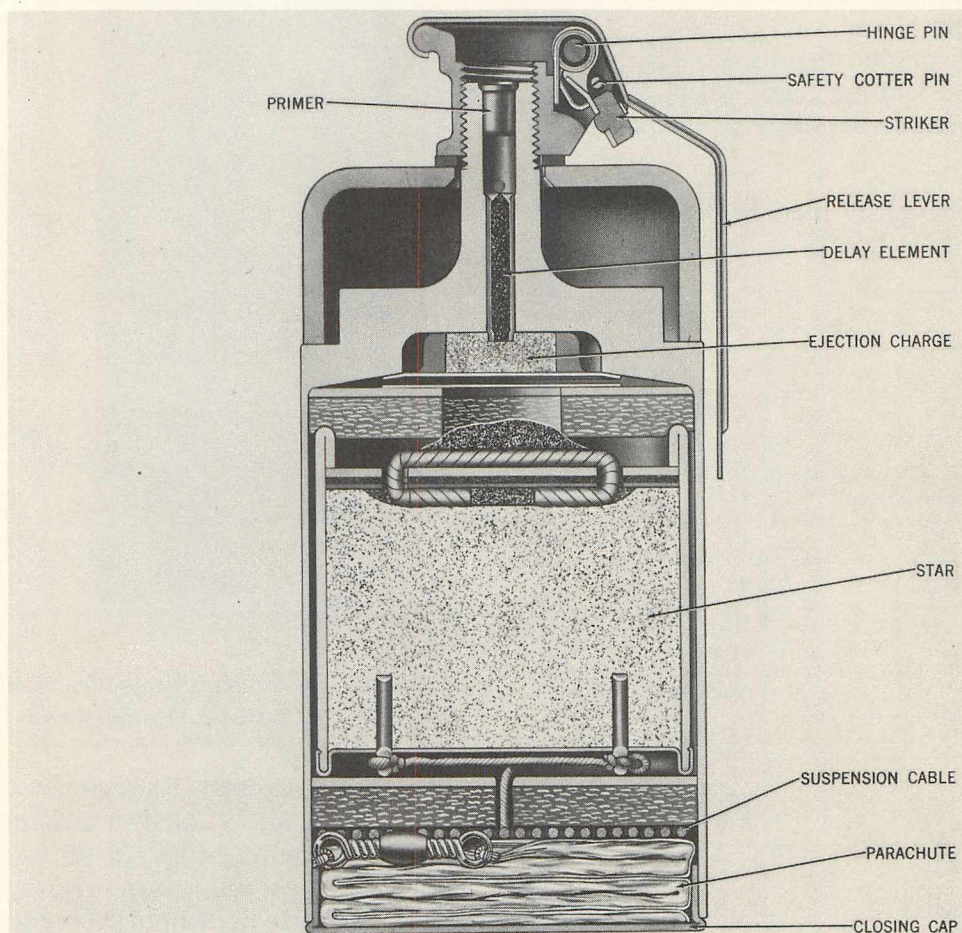


Figure 3.16—Aircraft Emergency Identification Signal Mk 6 Mod 0, Cross Section.



star, the mark and mod, manufacturer, lot, and the date of manufacture.

**Handling and Stowage.** For handling and stowage, see the introduction to this chapter.

**Safety Precautions.** In addition to the general precautions listed in the first section of this chapter, the following precautions should be observed.

Hold the release lever securely against the case of the signal until the signal is launched. This is important because after the safety cotter pin is removed, the release lever can move away from the body of the signal and release the striker. Only a small movement of the release lever is needed to free the striker.

Do not remove the safety cotter pin from the signal until it is held properly and is ready for launching.

Do not replace the safety cotter pin after it has been removed.

Do not examine the signal while it is in the plane, except for identification.

Do not remove the firing mechanism.

#### Aircraft Emergency Identification Signal Mk 7 Mod 0

Mk	7
Mod	0
Drawing No.	233405
Weight (lb)	1.8
Parachute Diameter (in.)	34
Delay (sec)	4
Burning Time (sec)	25
Color	Red, yellow, black, or green
Visibility (ft)	5000-6000
Primer	#4
Propellant Type Weight (oz)	Black powder 0.039
Illuminant (oz)	7.77-10.17
Shipping Container Number of Rounds Type Weight (lb)	12 Wood box 36

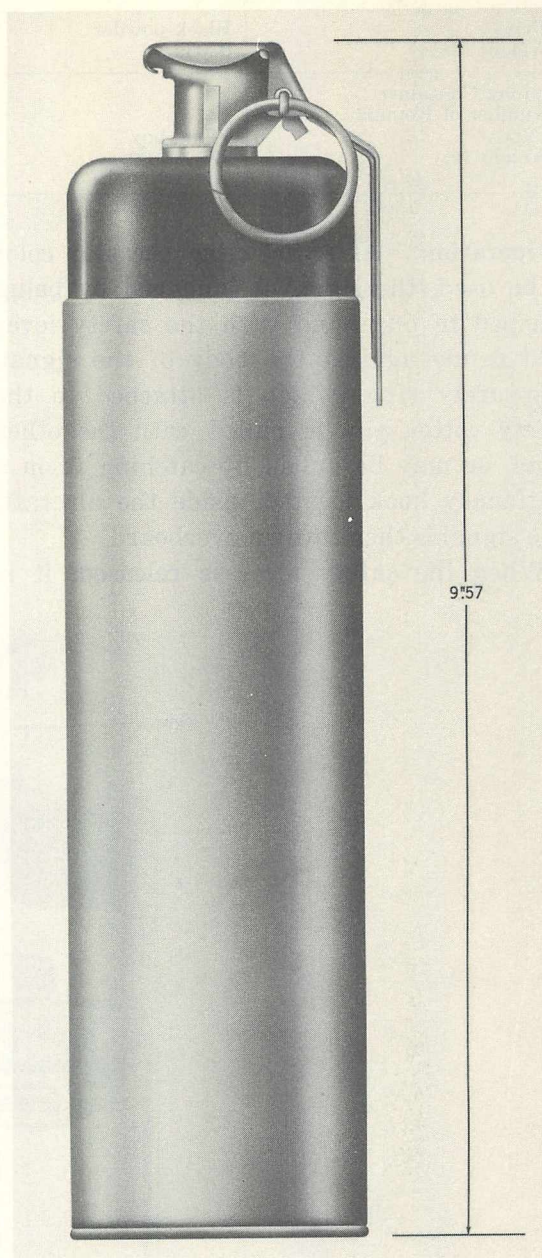


Figure 3.17—Aircraft Emergency Identification Signal Mk 7 Mod 0, External View.

**General.** Aircraft Emergency Identification Signals Mk 7 Mod 0 are used as a method of identification for aircraft. These signals produce red, green, yellow, or black smoke; they are parachute suspended.

The case of the signal is an aluminum cylinder with a grenade-type firing mech-



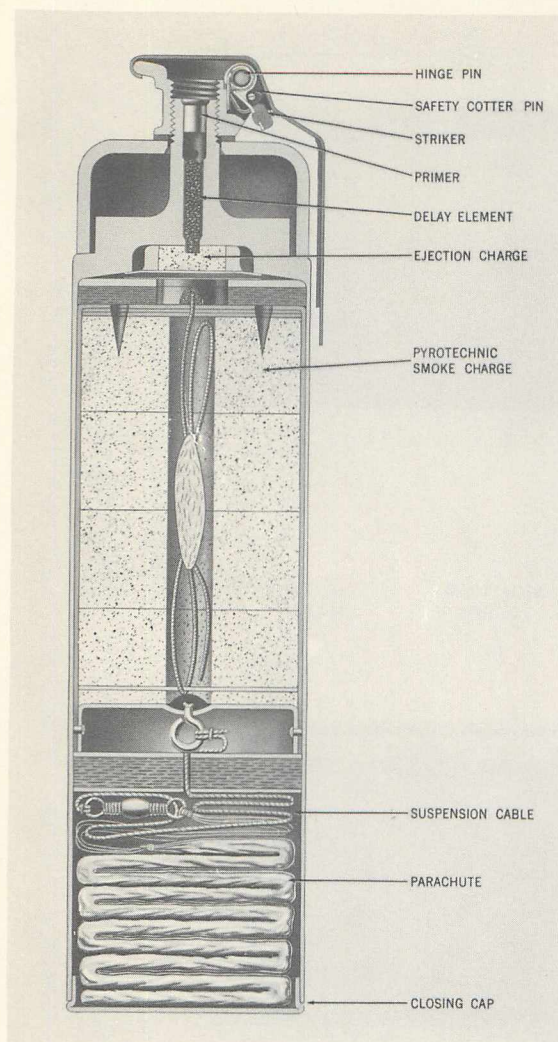


Figure 3.18—Aircraft Emergency Identification Signal Mk 7 Mod 0, Cross Section.

anism screwed into one end of the case, while the other end is closed by a metal cap. Inside the case is an ejection charge, pyrotechnic smoke charge, and a parachute. The parachute is made of silk, rayon, or paper.

**Operation.** To launch, the operator grasps the signal firmly in one hand, with the safety lever held against the body of the signal. The safety ring, which is attached to the safety cotter pin, is pulled with the other hand. The safety ring may be pulled by being caught on a stationary hook located inside the airplane. After the safety cotter pin has been

removed, the signal is launched by being thrown overboard.

When the signal has been launched, the safety lever is forced off the striker which is under spring tension. The striker rotates about the hinge pin and strikes the primer. The primer ignites the delay element, which ignites the ejection charge. The ejection charge pushes out the closing cap, parachute, and pyrotechnic smoke charge, and ignites the smoke charge. The parachute opens and suspends the signal.

**Identification.** The signals are identified as to color by the closing caps which are painted the same color as the smoke produced by the signal.

**Handling and Stowage.** For handling and stowage, see the introduction to this chapter.

**Safety Precautions.** In addition to the general precautions listed in the first section of this chapter, the following precautions should be observed.

Hold the release lever securely against the case of the signal until the signal is launched. This is important because after the safety cotter pin is removed, the release lever can move away from the body of the signal and release the striker. Only a small movement of the release lever is needed to free the striker.

Do not remove the safety cotter pin from the signal until it is held properly and is ready for launching.

Do not replace the safety cotter pin after it has been removed.

Do not examine the signal while it is in the plane, except for identification. This is to prevent accidental ignition of the signal.

Do not remove the firing mechanism.

**General.** Flash and Sound Signal M74 is used for training purposes to simulate the air burst of artillery. It is a cartridge-type signal which is projected and produces a loud report and a flash of light.

The signal consists of a one-piece outer aluminum case with a rimmed base. A percussion primer, located in the base of the outer case, extends into the propelling charge



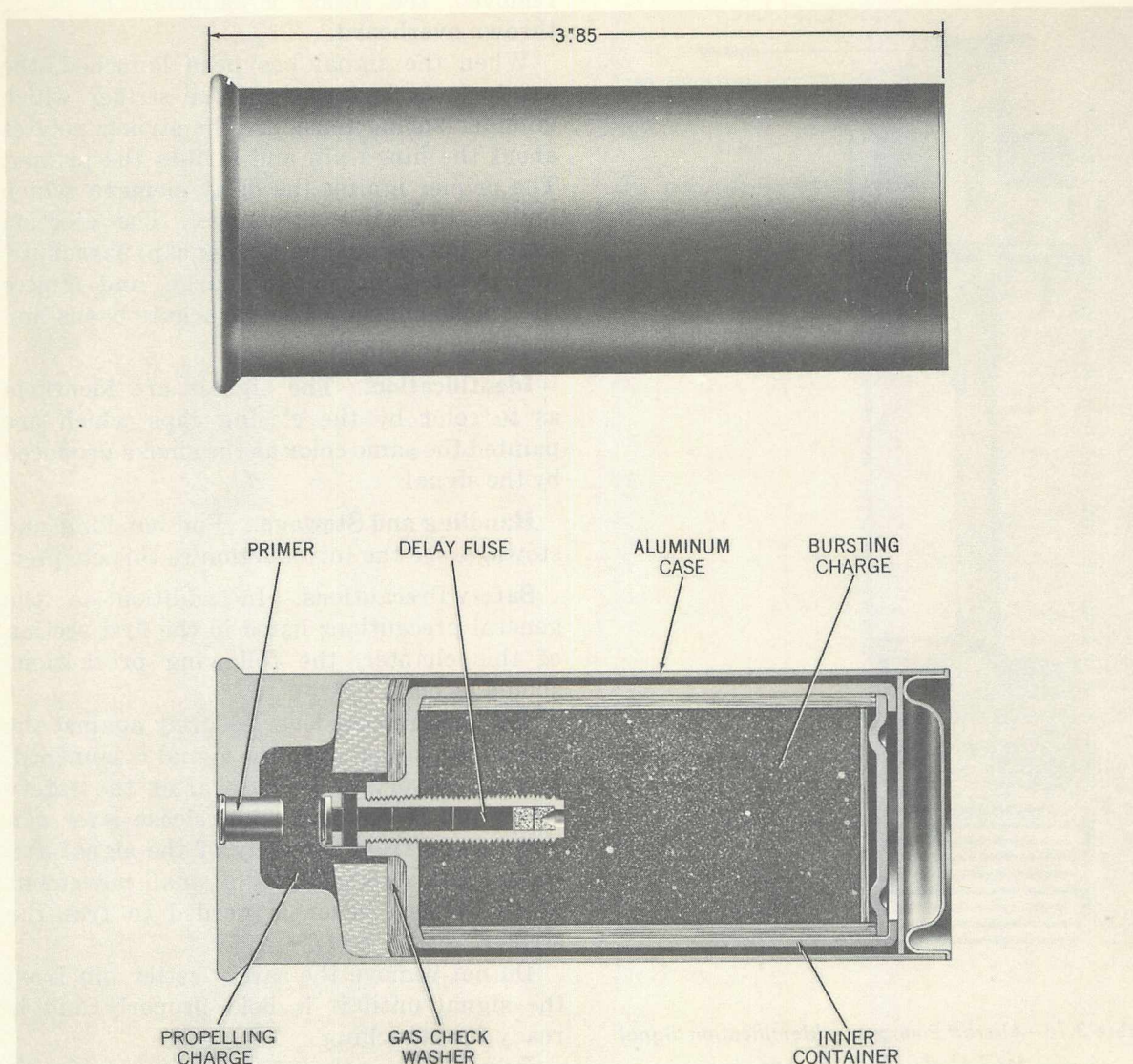


Figure 3.19—Flash and Sound Signal M74, External View and Cross Section.

which, in turn, contacts the delay fuse in the inner case. A steel cap closes the end of the signal. The case is aluminum color with pertinent information marked in black.

**Operation.** These signals are fired from Pyrotechnic Pistol AN-M8. When the firing pin of the pistol strikes the signal primer, the propelling charge is ignited. It projects the inner case and ignites the delay fuse. When the delay fuse burns to the pyrotechnic charge, the charge explodes and produces a flash of light and a loud report which are

distinguishable for some distance. Fragments of the inner case are very small and lose velocity quickly; they are not dangerous to personnel.

**Handling and Stowage.** Flash and Sound Signal M74 is to be handled and stowed as small arms ammunition.

**Safety Precautions.** When fired over personnel, the point of aim must not be less than 45 degrees above the horizontal to insure safety. At this angle of fire, the height of burst will be about 100 feet.



## Flash and Sound Signal M74

Model	M74
Drawing No.	78-0-96
Length (in.)	3.85
Diameter (in.)	1.7
Weight (oz)	5.4
Delay (sec)	2.2 to 3
Propellant Type Weight (grains)	Black powder 21
Bursting Charge Type Weight (lb)	Pyrotechnic Composition 0.08
Shipping Container Number of Rounds Type Weight (lb)	100 Wood 64

Personnel should not face the point of burst.

Helmets must be worn by all personnel exposed to the detonation of this signal.

**General.** Ground Signals M17A1 to M22-A1 series and M17A1B2 to M22A1B2 series are used for signaling by ground units. The signals are of the type which are launched from a rifle or carbine fitted with a launcher. They produce either a colored star supported by a parachute or a cluster of five free-falling stars.

All these signals are similar in appearance. The M17A1 to M22A1 series have aluminum bodies while the M17A1B2 to M22A1B2 series have steel bodies. The body is a cylinder with a closing cap at one end and a tail and fuse housing at the other end, which contains an expelling charge, a delay element, and a propelling charge. The tail is a hollow cylinder fitted with a circular fin. A cork plug with pull tape closes the finned end of the stabilizing tail. The pyrotechnic charge consists of a candle and its suspending parachute, or five star charges. Quickmatch carries ignition from the expelling charge to the candle or star charges.

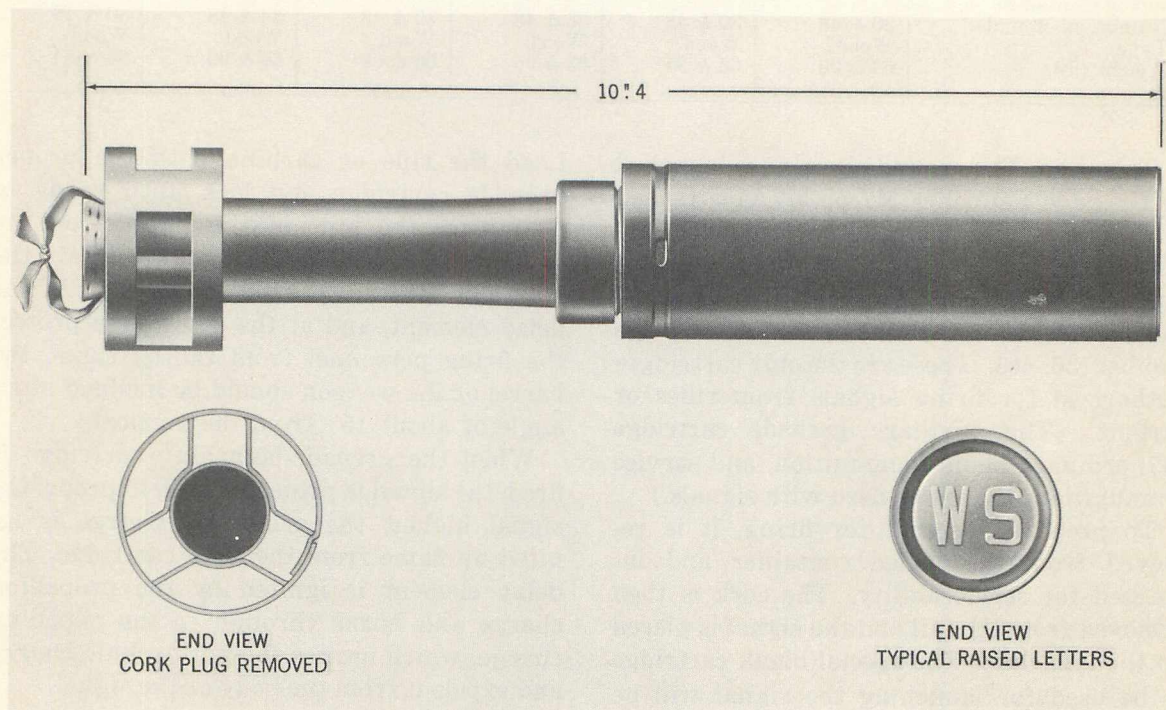


Figure 3.20—Ground Signals M17A1 to M22A1 Series and M17A1B2 to M22A1B2 Series, External View.



## Ground Signals M17A1 to M22A1 Series and M17A1B2 to M22A1B2 Series

Model Aluminum Construction Steel Construction	M17A1 M17A1B2	M19A1 M19A1B2	M21A1 M21A1B2	M18A1 M18A1B2	M20A1 M20A1B2	M22A1 M22A1B2
Drawing Nos. Aluminum Construction Steel Construction	78-0-37 78-0-54	78-0-39 78-0-56	78-0-41 78-0-58	78-0-38 78-0-55	78-0-40 78-0-57	78-0-42 78-0-59
Weight (lb)	1.04	1.02	1.00	1.03	1.10	1.06
Ignition Delay (sec)	5.5	5.5	5.5	5.5	5.5	5.5
Illuminant Burning Time (sec)	20-30	20-30	20-30	5-7	5-7	5-7
Candlepower	20M	5M	4M	5 stars 18M per star	5 stars 7M per star	5 stars 2M per star
Color	White	Green	Amber	White	Green	Amber
Rate of Fall (fps)	7	7	7	Free	Free	Free
Ignition Charge (oz)	0.04	0.04	0.04	0.04	0.04	0.04
Illuminant (oz) . . . . .	3.90	3.55	3.17	5.30	5.30	4.80
Propellant Powder (oz)	0.05	0.05	0.05	0.05	0.05	0.05
Expelling Charge Type	Black powder	Black powder	Black powder	Black powder	Black powder	Black powder
Weight (oz)	0.04	0.04	0.04	0.04	0.04	0.04
Shipping Container Number of Rounds Type	30 & 48 Wood	30 & 48 Wood	30 & 48 Wood	30 & 48 Wood	30 & 48 Wood	30 & 48 Wood
Weight (lb)	64 & 96	63 & 95	63 & 95	66 & 99	66 & 99	65 & 94

**Operation.** The ground signals are launched by Grenade Launcher M7 or M7A1 attached to a service rifle using Rifle Grenade Cartridge Caliber .30, M3, or they may be launched by Grenade Launcher M8 attached to a carbine using Carbine Grenade Cartridge Caliber .30, M6. These are the only cartridges authorized for firing signals from rifles or carbine. (The auxiliary grenade cartridge M7, ordinary blank ammunition, and service ammunition will not be used with signals.)

To prepare a signal for firing, it is removed from the sealed container and inspected for serviceability. The cork is then removed from the tail and the signal is placed on the launcher. The special blank cartridge to be used for launching the signal will be found fastened to the under side of the cork which was removed from the tail, or the blank cartridges may be packed separately.

Load the rifle or carbine with the proper grenade cartridge and lock until ready to fire; place the butt of the weapon on the ground. In order for the signal to attain the maximum altitude during the burning of the delay element, and at the same time protect the firing personnel from falling cases, the barrel of the weapon should be inclined at an angle of about 15° from the vertical.

When the grenade-launching cartridge is fired, the signal is projected and, to propel the signal higher, the propelling charge is ignited by flame from the fired cartridge. The delay element is ignited by the propelling charge and burns through to the expelling charge, which ignites the pyrotechnic charge and expels it from the body of the signal.

**Identification.** Markings on ground signals consist of nomenclature and other pertinent information. Night identification is



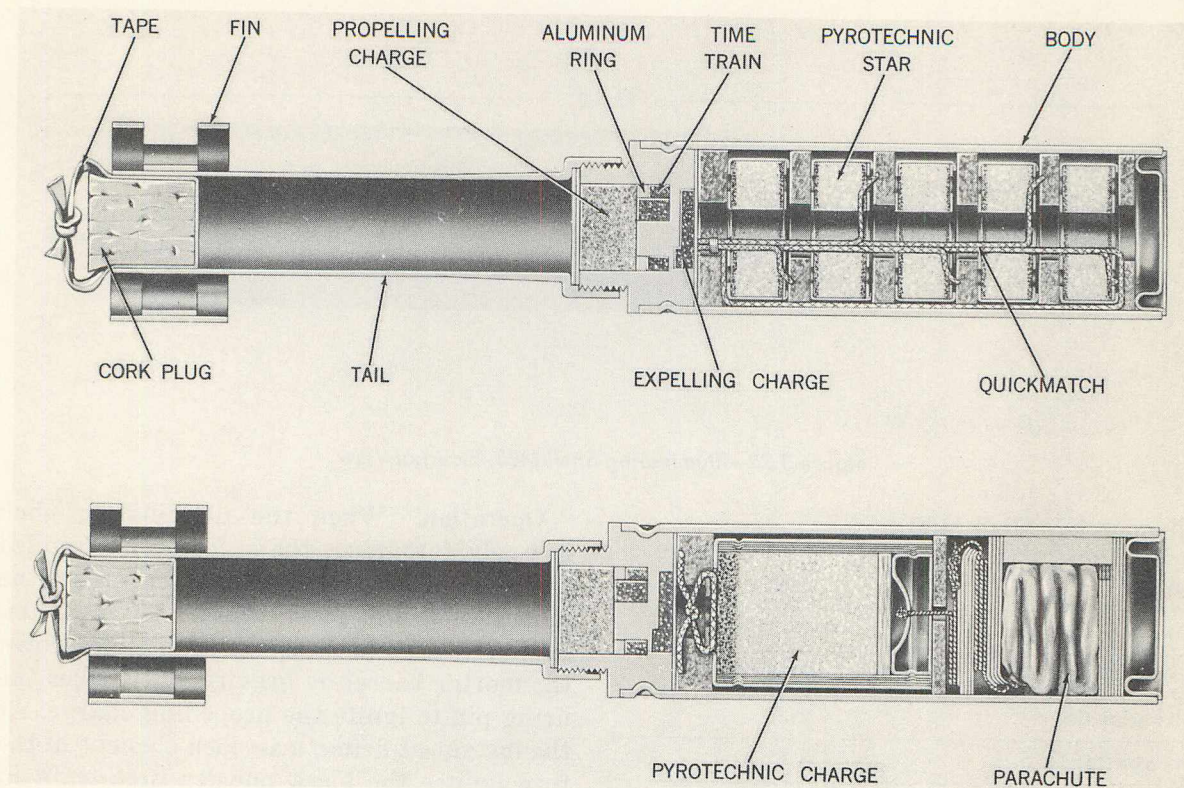


Figure 3.21—Ground Signals M17A1 to M22A1 Series and M17A1B2 to M22A1B2 Series, Cross Section.

facilitated by raised letters on the closing cap. The letter "W" indicates white, "G" indicates green, and "A" indicates amber. The letter "P" indicates a parachute-supported star, and the letter "S" indicates a cluster of five free-falling stars. Thus a closing cap with the letters "WS" would mean that the signal consists of a cluster of five white free-falling stars, and "GP" would indicate a parachute-supported green star.

**Packaging.** Ground signals are packed in individual fiber containers, 48 signals per box, with 50 M3 grenade cartridges and 30 M6 cartridges.

**Handling and Stowage.** Ground signals should be handled and stowed the same as small arms ammunition and pyrotechnic ammunition in general.

**Safety Precautions.** Containers must not be unsealed or corks removed until the signal is ready to be launched. If the signal is

not launched, it must be returned to its container and resealed.

Use only specified grenade launching cartridges.

Signals with cracked bodies, bent fins, deformed tail tubes, or with any other visual defect which might render them unserviceable must be discarded for disposal at a later time.

Personnel should not watch the flight of the signal because of possible "blow-back" of the propelling charge.

Signals should be fired in a direction so that falling cases will not hit friendly personnel or installations.

All personnel firing the signals or within range of falling parts should wear steel helmets.

**General.** The 60-mm Illuminating Shell M83 with the fixed time Fuze M65 is used by ground troops to illuminate objectives be-



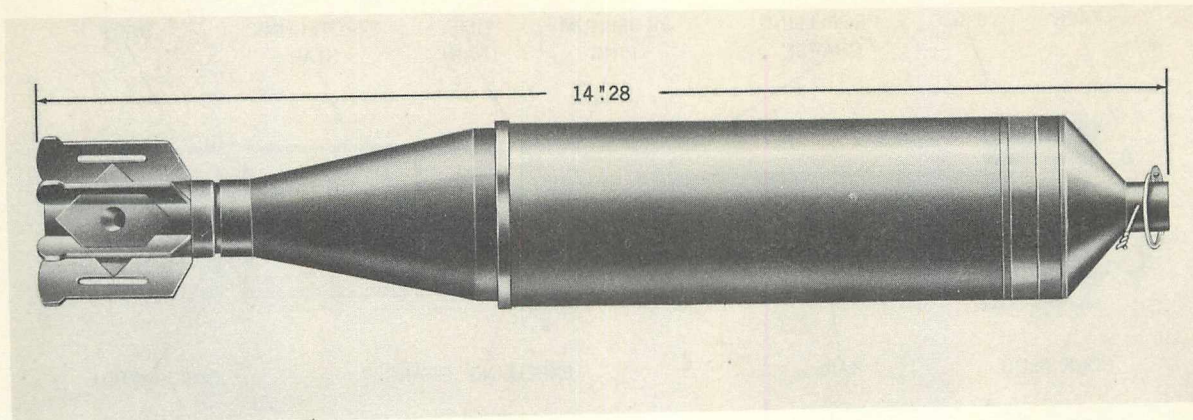


Figure 3.22—Illuminating Shell M83, External View.

### Illuminating Shell M83

Model	M83
Drawing No.	75-14-350
Length (in.)	14.2
Diameter (in.)	2.36
Weight (lb)	3.8
Ignition Delay (sec)	14.4-17.2
Burning Time (sec)	25
Candlepower	110,000
Rate of Fall (fps)	10
Suspension	Parachute
Propellant	M4
Primer	M32
Fuze	M65
Shipping Container Number of Rounds Type	18 Metal

yond the range of other pyrotechnic ammunition. It is fired from a 60-mm mortar. Fins on the tail assembly stabilize the shell in flight. Wedged into the fin blade slots are four increments of flake propellant powder which act as a propelling charge.

The shell is normally fired using all four propellant increments. This fact, and the fixed burning time of the fuze, causes the expulsion and ignition of the illuminant charge at a range of 800 yards and an altitude of 400 feet.

**Operation.** When the illuminating shell is ready for firing, the safety pin is pulled and the shell is dropped fins first down the muzzle of the mortar. The loader must immediately step back as the shell slides down the mortar barrel by gravity and strikes the firing pin to ignite the propelling charge. At the instant of firing, a setback element in the fuze ignites the black powder time train in the nose of the shell. This burns for 14 seconds and then ignites the expelling charge which ejects and ignites the pyrotechnic candle suspended on its parachute. The candle burns for 25 seconds and descends at a rate of about 10 feet per second.

**Packaging and Identification.** The shell is packed in individual fiber containers. Six containers are packed in one outer container, and three outer containers are shipped together, totaling 18 rounds per bundle. Each shell is painted gray with one white band and is marked in white to indicate the type and model, the mortar from which it is to be fired, the filler, and the lot number. The fuze flange on each shell is stamped to indicate the type and model.

**Safety Precautions.** The safety pin in the fuze is to be removed only as the shell is loaded into the mortar and at no other time. Should the round misfire, wait 30 seconds before removing the shell from the mortar to avoid the possibility of a hangfire, then replace the safety pin immediately.

The shear wire just beneath the safety pin



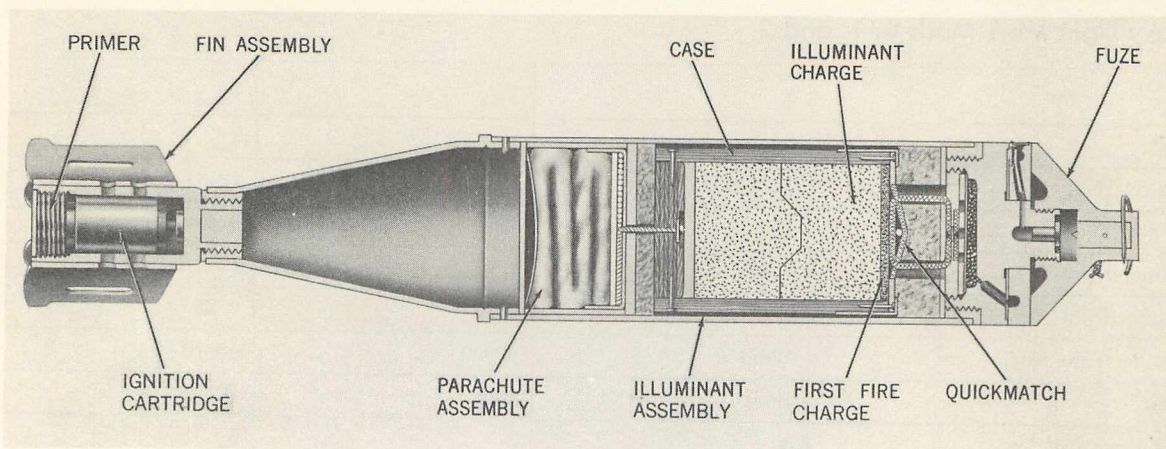


Figure 3.23—Illuminating Shell M83, Cross Section.

must not be disturbed. This fine wire passes through the fuze and has its ends twisted on the outside. If the wire is broken or missing, the round should be discarded.

Not more than the four propelling increments are to be used under any circumstances.

**General.** Navy Light Mk 1 Mods 0, 1, and 2 (Hand Type) burn with a brilliant light visible up to 3 miles at night. The Mod 0 produces a red light, the Mod 1 a blue light, and the Mod 2 a white light. The burning times of the lights are shown in the table.

Each light consists of a paper tube that contains the pyrotechnic substance and is fitted with a wooden handle at one end. The other end of the paper tube is closed by a cover that has an exterior coating of abrasive identical to that found on the scratching side

of a safety-match box. A small wad of cotton is contained just below the cover. The upper end of the paper tube is also covered by a cloth substance impregnated with the igniting compound. This substance is similar to that which makes up the head of a safety match.

**Operation.** The lights are ignited by tearing the tab seal which allows removal of the cover, and scraping the inverted cover across the top of the paper tube. In this operation it is advisable to hold the light at an angle of about 45° to avoid contact with the hot falling particles of the pyrotechnic candle. The light should be held at that angle throughout the burning.

**Shipment and Stowage.** The lights are shipped in metal containers holding 6 or 12

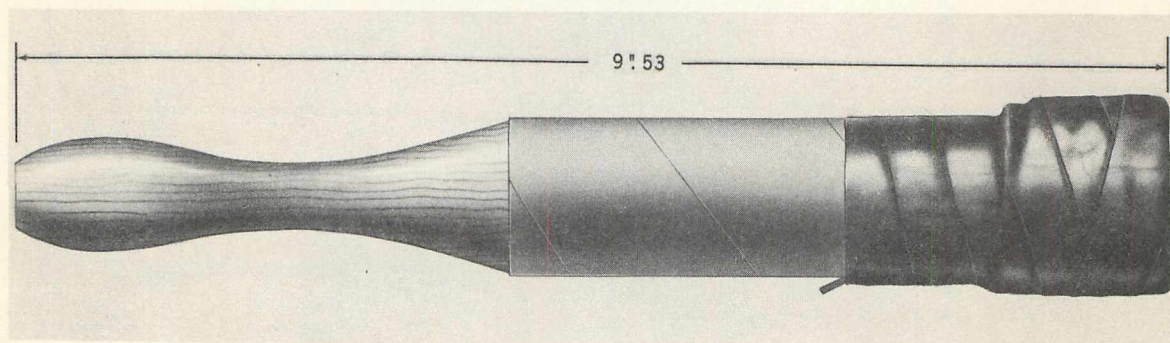


Figure 3.24—Navy Light Mk 1 Mod 2, External View.



## Navy Light Mk 1 Mods 0, 1, and 2

Mk	1	1	1
Mod	0	1	2
Drawing No.	344438	344438	1211715
Length (in.)	12	12	9.53
Diameter (in.)	1.45	1.45	1.45
Weight (lb)	0.35	0.35	0.35
Burning Time (sec)	120-150	60-90	60-70
Color	Red	Blue	White
Illuminant (oz)	3	3	3
Shipping Container Number of Rounds Type Weight (lb)	72 and 144 Cardboard 42 and 70	72 and 144 Cardboard 42 and 70	72 and 144 Cardboard 42 and 70

lights each. These are packed in cardboard cartons containing 72 or 144 lights each. As the lights are particularly subject to deterioration when exposed to moisture, they should not be removed from their containers until ready for use. Lights which have been left in an open container for more than 6 months should be turned back to the nearest ammunition depot or magazine at the earliest opportunity. Lights which have become chemically encrusted or which give off a vinegar odor should be disposed of immediately by being placed in a weighted sack and dumped overboard. A report of such action must be made to the Bureau of Ordnance.

**Safety Precautions.** The site at which

lights will be used must be carefully selected because burning particles that drop from the lighted candles may start a fire.

The light should be held up at an angle of about 45° and pointed to leeward during the burning.

**General.** Pistol Rocket Signals (Comet) Mk 1 Mod 0, Pistol Rocket Signals (Star) Mk 1 Mod 1, and Pistol Rocket Signals (Occulting) Mk 1 Mod 4 are used for signaling between surface craft and aircraft. They are fired from Rocket Pistol Mk 1 Mod 0 or Pyrotechnic Pistol AN-M8.

The Mod 0, which is the only mod of this signal used for emergency identification of surfaced submarines, produces a red, green,

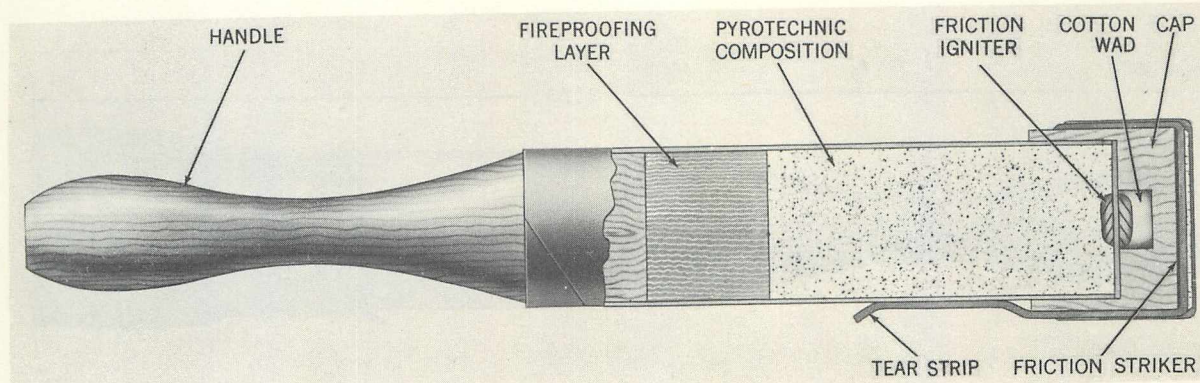


Figure 3.25—Navy Light Mk 1 Mod 2, Cross Section.



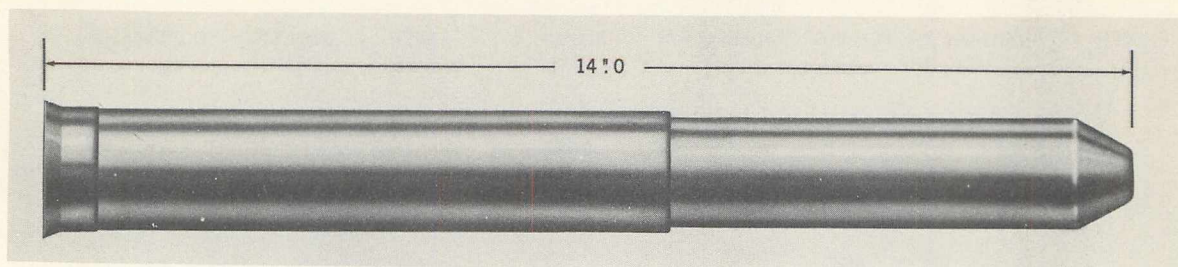


Figure 3.26—Pistol Rocket Signal Mk 1 Mods 0, 1, and 4, External View.

### Pistol Rocket Signal Mk 1 Mods 0, 1, and 4

Mk	1	1	1
Mod	0	1	4
Drawing No.	344418	344418	344418
Length (in.)	14	14	14
Diameter at Base (in.)	1.68	1.68	1.68
Weight (lb)	1	1	1
Burning Time (sec)	9–11	27–33	27–33
Rate of Fall (fps)	Free	7	7
Auxiliary Propelling Charge Type Weight (grams)	Black powder 0.80	Black powder 0.80	Black powder 0.80
Propellant Type Weight (grams)	Black powder 60	Black powder 60	Black powder 60
Expelling Charge Type Weight (grams)	Black powder 0.50	Black powder 0.50	Black powder 0.50
Shipping Container Number of Rounds Type Weight (lb)	50 Wood 87	50 Wood 87	50 Wood 87

or yellow star that burns for about 12 seconds as it falls freely to the surface. Mod 1 ejects a red, green, or white parachute-suspended star. Mod 4 ejects an “occluding-type” parachute-suspended star, that is, one that “blinks” on and off three times. The colors produced may be green-green-green, green-red-green, red-green-yellow, or red-red-red.

Mod 0 consists of an aluminum case and a rocket assembly. The case houses a standard Primer Mk 5, a felt pad, and a small auxiliary propelling charge. The rocket assembly con-

sists of a rocket motor and head. The rocket motor fits into the case. The motor contains a black-powder propellant and an expelling charge. Four folding vanes are attached to the base of the motor. Each vane is 4 inches long and about 1 inch wide. The head contains the pyrotechnic star.

Mods 1 and 4 have cases and motors similar to Mod 0. Their heads, however, contain parachutes and the different pyrotechnic charges.

**Operation.** When Mod 0 is fired, the



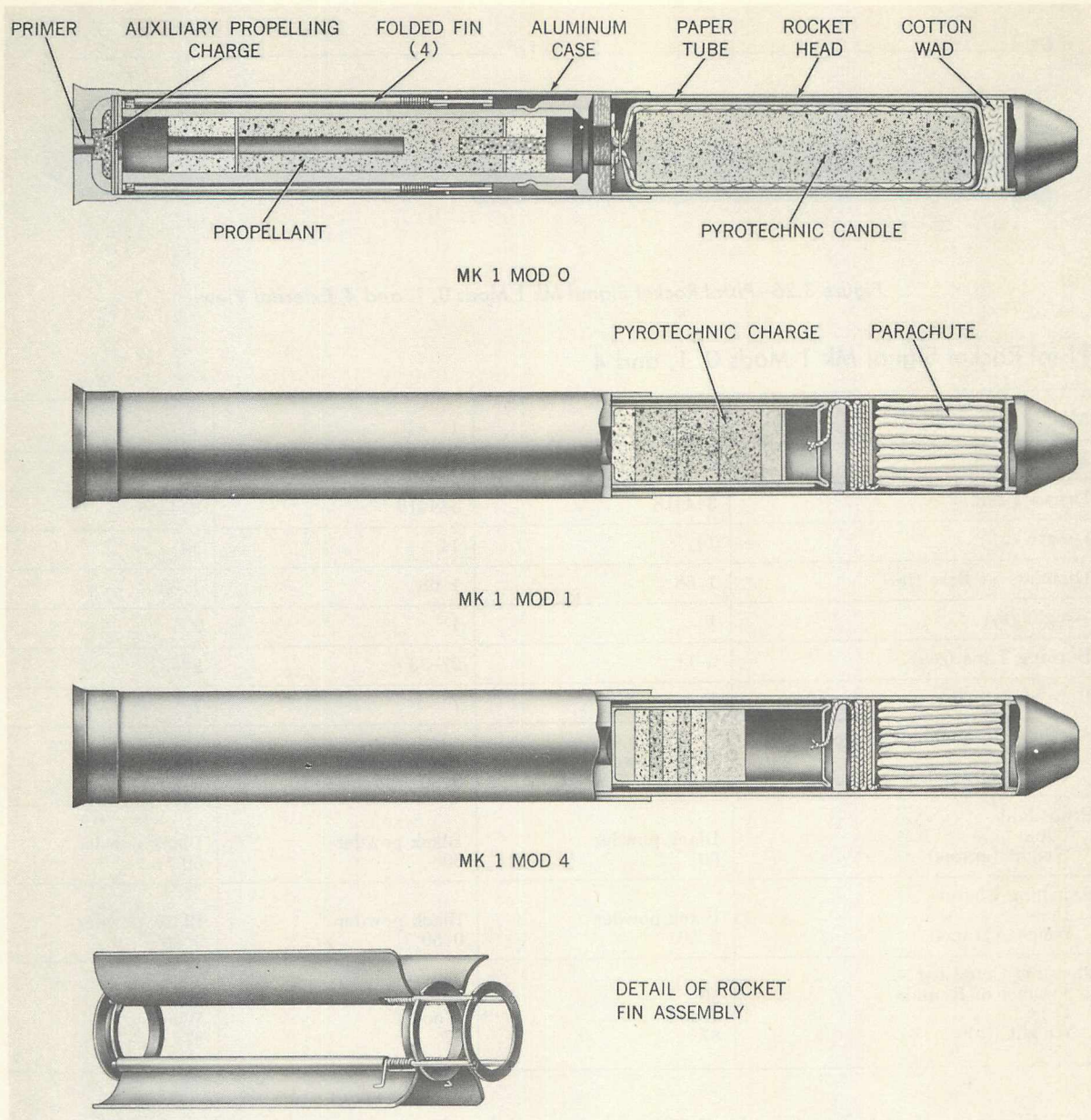


Figure 3.27—Pistol Rocket Signal Mk 1 Mods 0, 1, and 4, Cross Section.

primer ignites the auxiliary propelling charge in the case, which projects the rocket to a height of about 30 feet, and at the same time ignites the propellant in the rocket motor. The fins spring open and stabilize the flight of the rocket; it continues to rise to a height of 650 feet. The rocket leaves a trail of white light similar to the tail of a comet as it rises. The signal star of Mod 0 is then ig-

nited and ejected from the rocket head; it falls freely to the surface.

**Packaging and Identification.** Each signal is packed in a waterproof mailing tube container. Fifty such containers are shipped in a wood box. A metal container holding 12 signals (Mod 0) is available for issue to submarines. The signals must not be removed from their individual containers until



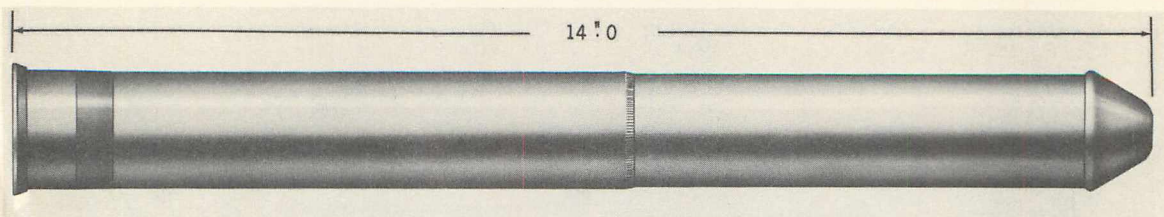


Figure 3.28—Pistol Rocket Signal Mk 2 Mod 1, External View.

ready for use. Colors of the signal stars are marked on the paper containers. Signals which are removed from their individual containers, but not used, must be dried thoroughly before they are replaced in their containers for stowage.

**Safety Precautions.** Always point a pistol loaded with one of these signals slightly outboard and away from surrounding personnel or vessels. This precaution should also be taken when loading new signals into the breech of the pistol.

Faulty or misfired signals should never be disassembled.

**General.** Pistol Rocket Signal (Smoke) Mk 2 Mods 0 and 1 is used for signaling between surface craft and aircraft. It is fired from Rocket Pistol Mk 1 Mod 0 or Pyrotechnic Pistol AN-M8.

Mod 1 is very similar to Mod 0. It differs in construction details of the rocket motor and in the weight of the expelling charge.

The smoke signal may be red, yellow, black, orange, green, or violet. It is parachute suspended.

The signal consists of an aluminum case and a rocket assembly. The case houses a standard Primer Mk 5, a felt pad, and a

#### Pistol Rocket Signal (Smoke) Mk 2 Mods 0 and 1

Mk	2	2
Mod	0	1
Drawing No.	344599	344672
Length (in.)	14	14
Diameter at Base (in.)	1.68	1.68
Weight (lb)	1	1
Burning Time (sec)	20-30	20-30
Rate of Fall (fps)	7	7
Auxiliary Propelling Charge Type Weight (grams)	Black powder 0.80	Black powder 0.80
Propellant Type Weight (grams)	Black powder 60	Black powder 60
Expelling Charge Type Weight	Black powder 0.50	Black powder 0.94
Shipping Container Number of Rounds Type Weight (lb)	50 Wood 87	50 Wood 87



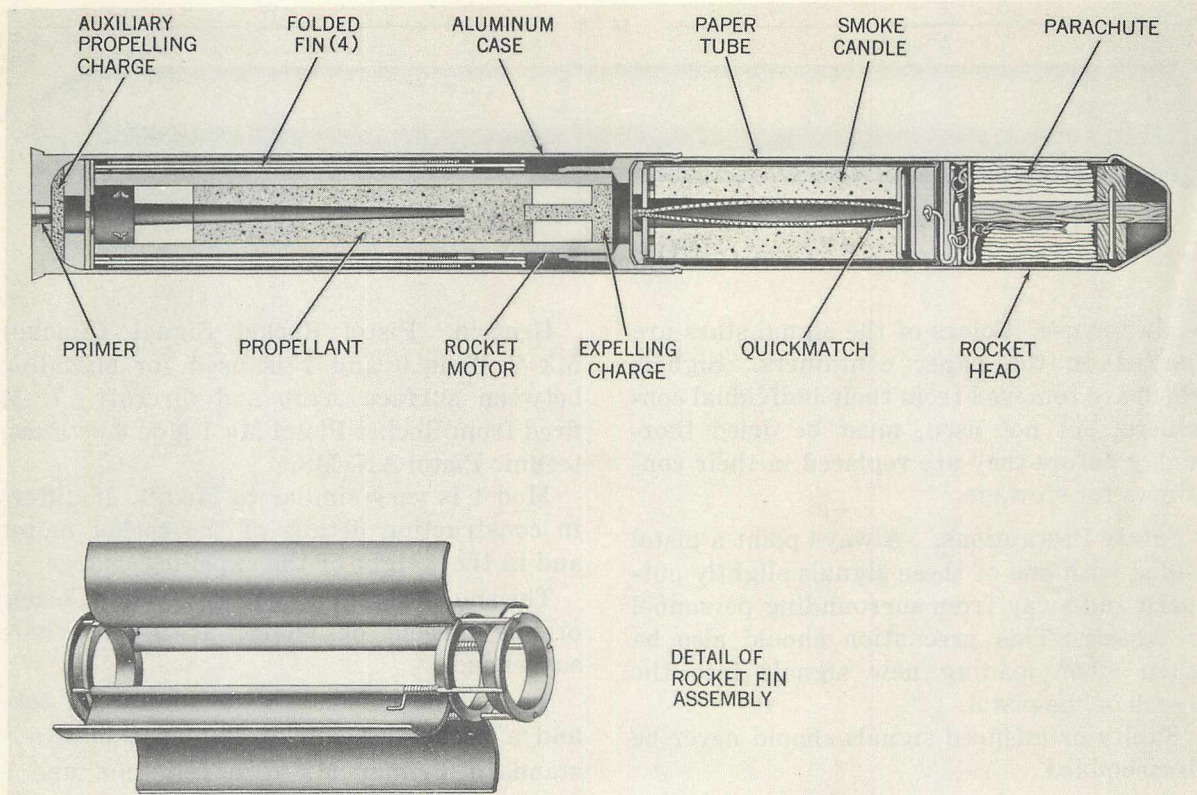


Figure 3.29—Pistol Rocket Signal Mk 2 Mod 1, Cross Section.

small auxiliary propelling charge. The rocket assembly consists of a rocket motor and head. The rocket motor, which fits into the case, contains a black-powder propellant and an expelling charge. Four folding vanes are attached to the base of the motor. Each vane is 4 inches long and about 1 inch wide. The head contains the smoke candle.

**Operation.** When the signal is fired, the primer ignites the auxiliary propelling charge in the case, which projects the rocket to a height of about 30 feet, and at the same time ignites the propellant in the rocket motor. The fins spring open and stabilize the flight of the rocket, and it continues to rise to a height of 650 feet. At the peak of its trajectory, the smoke candle is ignited and ejected with its parachute from the rocket head.

**Packaging and Identification.** Each signal is packed in a waterproof mailing tube container. Fifty such containers are shipped

in a wood box. The signals must not be removed from their individual containers until ready for use. Colors of the smoke signals are marked on the paper containers. Signals which are removed from their individual containers, but not used, must be dried thoroughly before they are replaced in their containers for stowage.

**Safety Precautions.** Always point a pistol loaded with one of the signals slightly outboard and away from surrounding personnel or vessels. This precaution should also be taken when loading new signals into the breech of the pistol.

Faulty or misfired signals should never be disassembled.

**General.** Pistol Rocket Signal (Shower, Single Burst) Mk 3 Mod 0 is used for emergency identification by surfaced submarines. It is fired from Rocket Pistol Mk 1 Mod 0 or Pyrotechnic Pistol AN-M8. The signal produces a white shower.



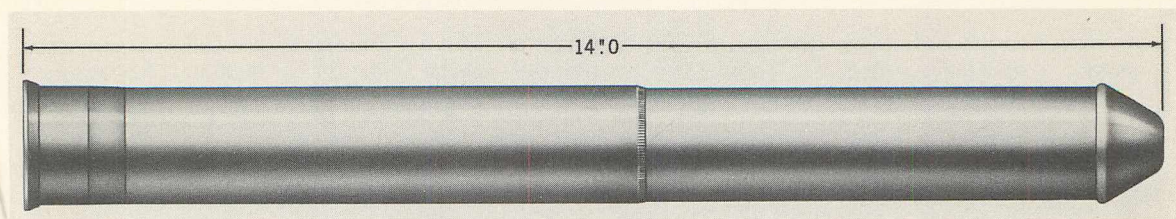


Figure 3.30—Pistol Rocket Signal (Shower, Single Burst) Mk 3 Mod 0,  
External View.

### Pistol Rocket Signal (Shower, Single Burst) Mk 3 Mod 0

Mk	3
Mod	0
Drawing No.	344701
Length (in.)	14
Diameter at Base (in.)	1.68
Weight (lb)	1
Burning Time (sec)	3-5
Auxiliary Propelling Charge Type Weight (grams)	Black powder 1
Propellant Type Weight (grams)	Black powder 60
Expelling Charge Type Weight (grams)	Black powder 0.94
Shipping Container Number of Rounds Type Weight (lb)	50 Wood 95

The signal consists of an aluminum case and a rocket assembly. The case houses a standard Primer Mk 5, a felt pad, and a small auxiliary propelling charge. The rocket assembly consists of a rocket motor and head. The rocket motor fits into the case. The motor contains a black-powder propellant and an expelling charge. Four folding vanes are attached to the base of the motor. Each vane is 4 inches long and about 1 inch wide. The head contains about 60 pyrotechnic pellets.

**Operation.** When the signal is fired, the primer ignites the auxiliary propelling

charge in the case, which projects the rocket to a height of about 30 feet, and at the same time ignites the propellant in the rocket motor. The fins spring open and stabilize the flight of the rocket, and it continues to rise to a height of 650 feet. At the height of its trajectory, the pellets are ignited and ejected in a shower from the rocket head.

**Packaging and Identification.** Each signal is packed in a waterproof mailing tube container. Fifty such containers are shipped in a wood box. The signals must not be removed from their individual containers until ready for use. Colors of the smoke signals are marked on the paper containers. Signals which are removed from their individual containers, but not used, must be dried thoroughly before they are replaced in their containers for stowage.

**Safety Precautions.** Always point a pistol loaded with one of the signals slightly outboard and away from surrounding personnel or vessels. This precaution should also be taken when loading new signals into the breech of the pistol.

Faulty or misfired signals should never be disassembled.

**General.** Red Star Parachute Distress Signal M131 is used from ground units to aircraft or from ground units to other ground units. Because of the high altitude which this signal reaches, it can be fired through low clouds or ground fog to attract the attention of aircraft. The signal is a spin-stabilized rocket contained in an expendable launcher.



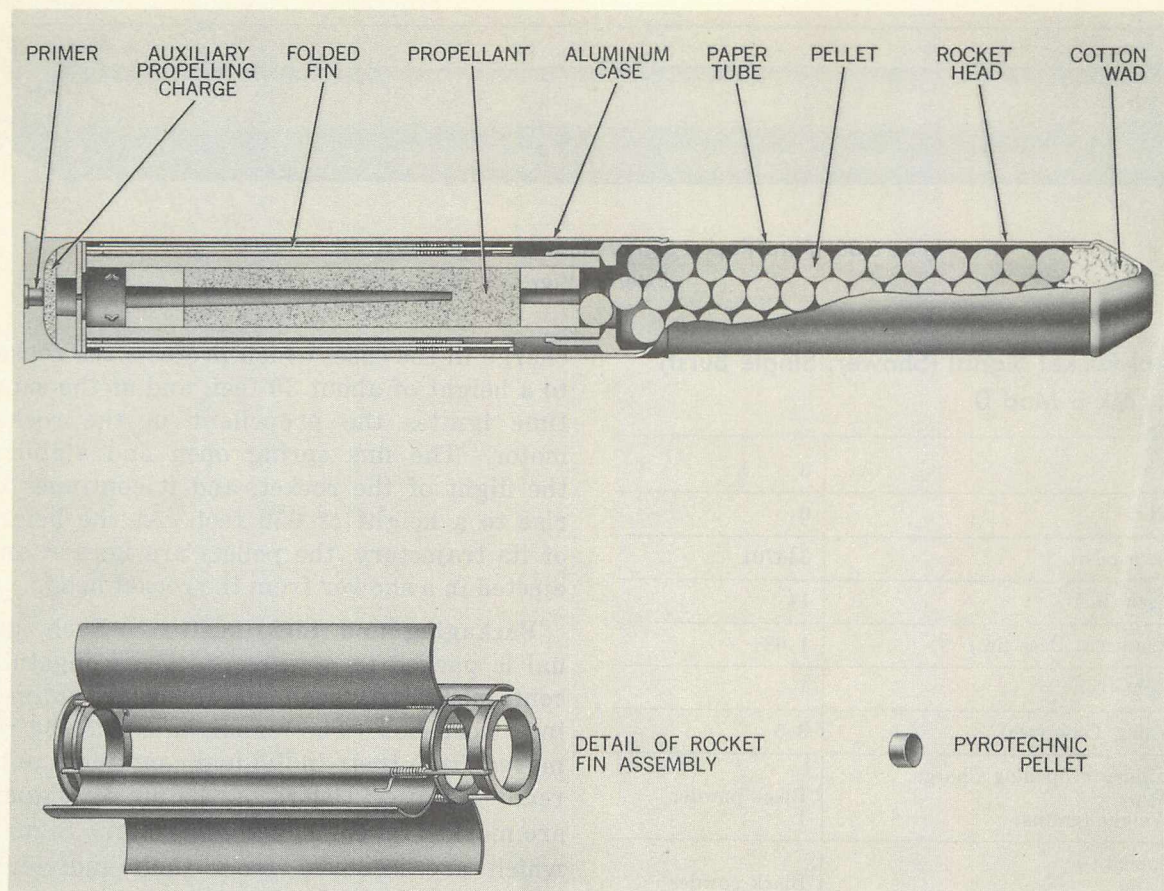


Figure 3.31—Pistol Rocket Signal (Shower, Single Burst) Mk 3 Mod 0, Cross Section.

The signal (or rocket) consists of a cylindrical case containing a parachute, a pyrotechnic candle, an expelling charge, a delay element, a rocket propellant, and a quick-match rocket igniter. The base of the case is closed with a plug in which there are

three nozzles. Two pins, diametrically opposite, protrude from the base and fit into spiral grooves in the launcher. The launcher is closed at the base by a steel housing which contains the firing mechanism and the primer. Above the primer is a propelling

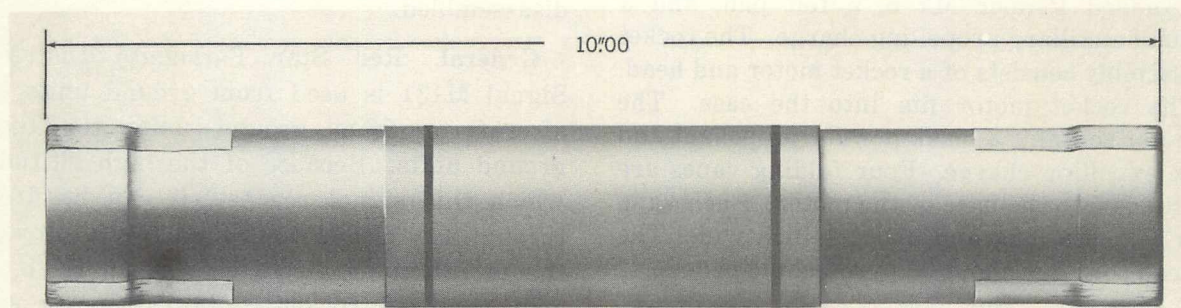


Figure 3.32—Red Star Parachute Distress Signal M131, External View.



## Red Star Parachute Distress Signal M131

Model	M131
Drawing No.	P-83504
Length (in.)	9.2
Diameter (in.)	1.66
Weight (lb)	1.21
Burning Time (sec)	30
Height of Rise (ft)	1500
Visibility (mi)	30
Propelling Charge Type Weight (grams)	Black powder 1.5
Shipping Container Number of Rounds Type Weight (lb)	28 Wood box 53.5

charge of black powder. The firing mechanism consists of a spring-loaded firing pin or striker, a striker release, and a safety bar. The signal is issued with a cover over the firing mechanism, which prevents movement of the safety bar and precludes accidental firing of the signal. The striker release functions as a trigger, being a notched steel pin which engages the striker until the button on the end of the striker release is pushed.

**Operation.** The signal is prepared for firing by first grasping the pull ring and completely breaking the seal around the water-

proof container, then removing the launcher. The signal launcher is held in one hand with the rocket end up. Next, the covers are removed from both the rocket end and the firing-mechanism end. The rocket end must be kept pointed up and away from the body at all times. To fire the signal, release the safety bar and press the release button, keeping the signal at arm's length and about eye level. Use both hands when firing.

When the striker is released, it fires the primer which ignites the propelling charge. The signal is projected with a spin which stabilizes it during flight. The quickmatch is ignited by the propelling charge and ignites the rocket propellant when the signal has reached a height of about 50 feet. The rocket propellant burns and propels the rocket to a point where the expelling charge is ignited. This ignites the star and forces both the star and its parachute from the case.

**Packaging and Identification.** The signal is packed in a waterproof container marked with a white label listing pertinent data and instructions for its removal. A red label on the launcher is similar except that it contains instructions for firing, and indicates the "rocket end" and "trigger end." The trigger is painted red and the safety bar green.

**Safety Precautions.** Two hands should be used when firing this signal.

Caution must be used so that the signal

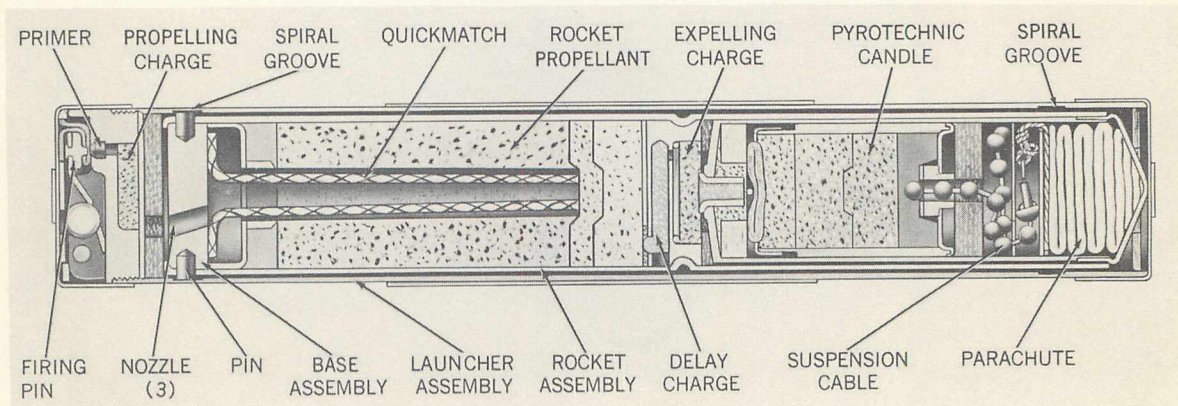


Figure 3.33—Red Star Parachute Distress Signal M131, Cross Section.



is not pointed toward personnel or flammable material.

If the signal is not fired, reset the safety bar, then replace and reseal the metal closing cover.

**General.** Submarine Emergency Identification Signals Mk 3 Mods 1, 2, and 3 are for either day or night use; they are used only with the submarine signal ejector. On rising to the surface of the water, the signals project an inner container to a height of 250 feet, where a parachute opens and supports a star, which burns approximately 13 seconds. The signals are available in three colors—red, green, or yellow.

The signals are 18.5 inches long and 3 inches in diameter. One end is closed with

an ogive nose cap; the other end carries the ignition device. When the signal is fired from the submarine signal ejector, the tripping lever rides in a groove in the ejector and is tripped when the end of the groove is reached, about 9 inches from the muzzle door. The safety cotter pin prevents movement of the tripping lever until after the signal is loaded in the ejector. When the tripping lever operates the firing-pin lever, the primer is struck and flashes into the combination delay unit and ejection charge.

#### Operation.

**PREPARING THE SIGNAL FOR FIRING.** Use the following procedure to prepare a signal for firing and to load a signal into the ejector.

1. Examine the signal to see that it has

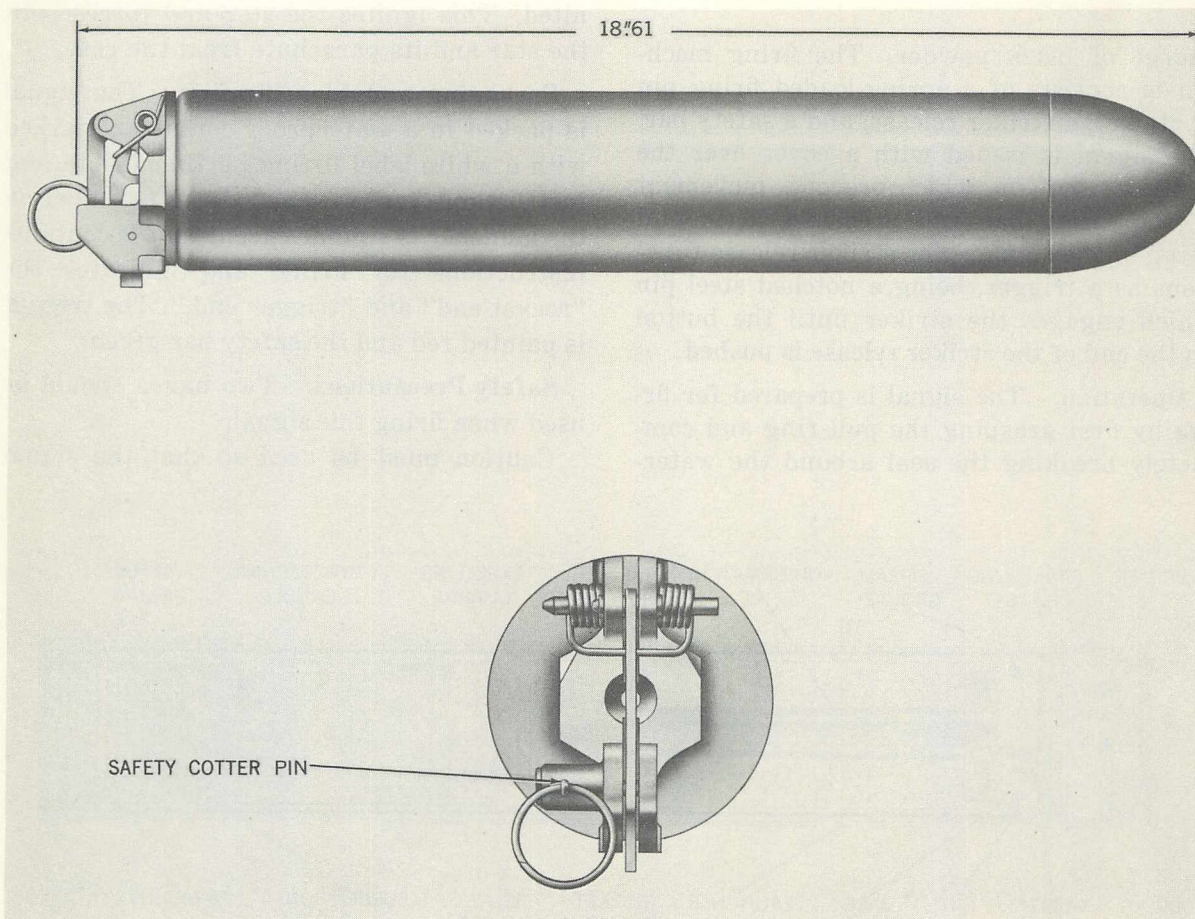


Figure 3.34—Submarine Emergency Identification Signal Mk 3 Mod 3, External View.



## Submarine Emergency Identification Signal Mk 3 Mods 1, 2, and 3

Mk	3	3	3
Mod	1	2	3
Drawing No.	398960	490274	1331797
Length (in.)	18.61	18.61	18.61
Diameter (in.)	3	3	3
Weight (lb)	3.15	3.15	3.15
Parachute (in.)	20	20	20
Delay (sec)	54	54	54
Burning Time (sec)	13	13	13
Candlepower Red Green Yellow	15,000 9600 4500	15,000 9600 4500	15,000 9600 4500
Maximum Launching Depth (ft)	285	285	285
Maximum Height of Rise (ft)	250	250	250
Ignition Charge (grains)	0.5	0.5	0.5
Illuminant (oz)	5	5	5
Expelling Charge (oz)	0.07	0.07	0.07
Propelling Charge Type Weight (oz)	Black powder 0.85	Black powder 0.85	Black powder 0.85
Shipping Container Number of Rounds Type Weight (lb)	25,6 Wood, Metal 101,37	25,6 Wood, Metal 101,37	25,6 Wood, Metal 101,37

not been dropped; that the firing pin and tripping lever have not been forced, bent, struck, or pulled; that the case is not dented or otherwise deformed; and that the nose seal is intact.

2. Carefully attach the snap hook of a lanyard to the ring on the eye end of the safety cotter pin.

**WARNING**

The safety pin should not be removed from the signal until the signal has been completely loaded. This is extremely important for personnel safety.

3. Load the signal in the barrel by pushing it forward toward the muzzle until the spring loaded detent drops down behind the signal.

4. While loading, pay particular attention to the following details.

a. Be sure that the lanyard does not foul, causing the pin to be pulled.

b. Use no force whatsoever when loading the signal.

c. If difficulty is encountered when loading a signal and no other cause is evident, it should be assumed that the signal is faulty. In this case, the Gunnery Officer will be informed, and he will direct disposition of the signal. Use a new signal in place of the rejected one.

d. Even with the tripping groove clear, it may be possible for the tripping lever to catch at the point where the water-ejection and drain piping joins the ejector barrel.

e. Be sure that the guide of the signal is



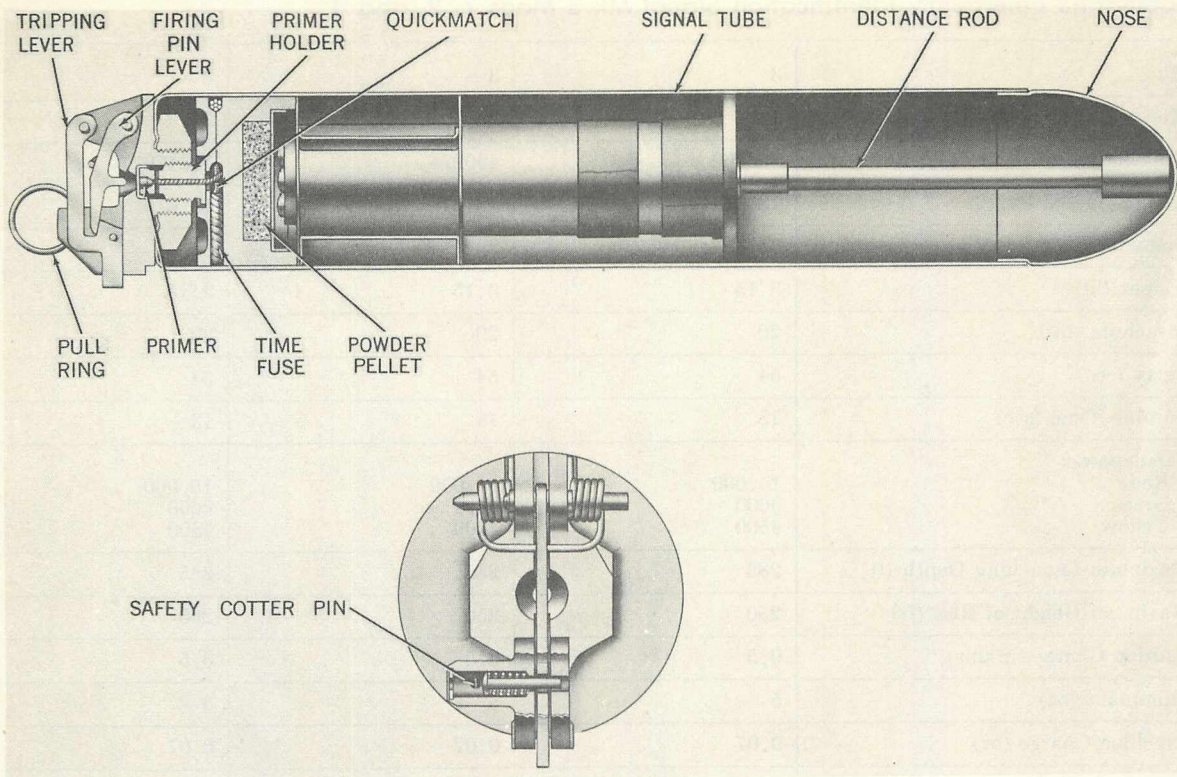


Figure 3.35—Submarine Emergency Identification Signal Mk 3 Mod 3,  
Cross Section.

in the guide groove of the ejector. It has recently been discovered that an occasional Mk 3 Mod 1 signal may have a short guide that may leave the guide groove at any point. This can cause the signal to bind in the ejector.

5. With the signal in the loaded position and ready to be fired, withdraw the safety cotter pin with the lanyard by exerting a steady pull. Do not use a metal rod with a fork or hook for withdrawing the safety pin since this method will require more exposure of the body at the breech of the ejector.

#### WARNING

1. The safety cotter pin must not be pulled until after the signal has been pushed beyond the detent and the breech door is about to be closed.
2. Personnel must keep clear of the breech of the signal ejector.
6. Close the breech door quickly and lock it

shut. After the safety pin has been removed and the breech door closed, the muzzle door should be opened without delay. Proceed with the instructions found in the paragraphs dealing with firing procedures.

7. Whether or not attempts are made to fire, signals will not be removed from the ejector without authorization of the Commanding Officer. The procedure for removing signals is given further on in this section.

**FIRING THE SIGNAL EJECTOR HYDRAULICALLY.** To fire the signal hydraulically, proceed as follows.

1. Check to see that the muzzle door is closed, the drain open, and the vent open.
2. Build up air impulse to firing pressure. Use pressure 50 pounds greater than sea pressure. Cut air in to the signal gun.
3. Open the breech door of the ejector and examine for "bore clear." Use a flashlight. Be sure that the tripping groove is free of



foreign matter all the way up to the tripping point.

4. Examine and load the signal.

5. Close the drain valve and breech door.

6. Flood the barrel from the sea, forcing air from the barrel through the vent line. When water escapes from the vent, close the vent and equalizer valve, and open the muzzle door.

7. Immediately prior to firing, verify that the impulse pressure exceeds the sea pressure by 50 pounds. If the submarine does not have sight glasses on the ejectors, proceed to steps 8 through 11. If sight glasses have been installed, proceed to steps 12 through 16.

8. Fire the ejector, holding the firing lever in the firing position for 5 seconds. Return the lever to neutral, wait 5 seconds, and then repeat the firing operation. In other words, the ejector should be fired twice for each signal. Next, pull the handle to the "Vent" position to relieve pressure in the expulsion tank.

9. Leave the muzzle door open for a period of 2 minutes after firing. This is twice the duration of the time fuze of the signal. At the end of this safety period, shut the muzzle door; vent and drain the ejector.

10. On opening the breech door, keep all parts of the body out of line with the ejector barrel. Determine "bore clear" by means of a stiff ramrod which may be inserted without placing hands or other parts of the body in line with the ejector barrel.

11. If, on opening the breech door, a signal is found remaining in the barrel, the breech door shall be immediately closed, the ejector flooded, and the muzzle door opened. Additional attempts to fire may be made if so directed, but under no circumstances will the breech door be reopened in less than 10 minutes after the last firing attempt. See the paragraphs dealing with the removal of signals.

12. If sight glasses have been installed, fire the ejector, holding the firing lever in firing position for 5 seconds. Return the lever to neutral.

13. Determine by observation through sight glasses whether the signal has left the

ejector. If the signal did not leave the ejector, wait 5 seconds and repeat the firing operation. If the signal still remains in the ejector, wait 10 minutes before attempting to remove it. See the paragraphs dealing with the removal of signals.

14. If the signal cleared the ejector, pull the handle to the "Vent" position to relieve the pressure in the expulsion tank.

15. No delay is necessary before closing the muzzle door and opening the breech door provided the signal is known to have been ejected as determined by observation through sight glasses.

16. Reload or secure the ejector.

**FIRING THE SIGNAL EJECTOR MANUALLY.** The following procedure for firing the signal gun with the ram will apply in most cases when manual operation of the signal gun is necessary.

1. Pull the ram all the way back; check to see that the muzzle door is closed; open the ram breech door.

2. Remove the breech door and ram. When the breech door is down and out of the way, load the signal.

3. Enter the ram behind the signal, and lock the special breech cover in place. This cover is constructed to permit operations of the interlock and rotation of the locking ring.

4. Close the drain valve and open the vent valve.

5. Open the equalizer valve and, when water escapes from the vent, close the vent and flood valves.

6. Open the muzzle door.

7. Push the projectile out by means of the ram.

8. Withdraw the ram at least 4 inches and close the muzzle door.

9. Open the vent and drain lines.

10. Unlock and open the breech cover, and withdraw the ram.

11. Reload or secure the ejector.

**REMOVING A SIGNAL BEFORE ATTEMPTING TO FIRE.** If no attempt has been made to fire and it is necessary to remove a signal from the ejector, the following procedure



will be carried out carefully, upon authorization of the Commanding Officer.

1. Remove the signal partially from the ejector until the primer can be inspected. Keep out of line with the signal.

2. Inspect the primer to make sure it has not been fired. The exposed copper surface should be smooth and not dented.

3. If the primer has been fired or dented, replace the signal in the ejector, being careful not to trip the firing lever; close the breech door and the flood ejector and open the muzzle door as quickly as possible. Wait at least 10 minutes before removing the signal from the ejector in accordance with the procedure given in the paragraph "Removing a signal after attempting to fire."

4. If the primer has not been dented, remove the signal from the ejector, depress the jump-out pin, and insert the safety cotter pin. (The jump-out pin is in the boss from which the safety cotter pin was pulled.)

5. Dry the signal case.

6. Inspect the signal for damage which may have occurred during handling. Pay particular attention to the nose seal.

7. Tag the signal.

8. If damaged, lay the signal aside and dispose of it in accordance with current BuOrd instructions.

9. If serviceable, use the signal at the next opportunity.

**REMOVING A SIGNAL AFTER ATTEMPTING TO FIRE.** If a signal is discovered in the ejector after attempts to fire have been made, immediately close the breech door, flood the ejector, and open the muzzle door. (If the ejector has sight glasses, it will be unnecessary to open the breech door to determine whether the signal has left the ejector.) Wait at least 10 minutes after reflooding the ejector or after the last attempt to fire, if additional attempts to fire have been made, before opening the breech door. Carefully carry out the following procedure in removing the signal from the ejector.

1. Keeping the body out of line with the signal, remove the signal from the ejector.

2. Depress the jump-out pin and insert the safety cotter pin.

3. Tag the signal.

4. Lay the signal aside and dispose of it in accordance with current BuOrd instructions.

**Stowage.** For shipboard stowage, signals should be placed in gasket-sealed metal containers.

**Safety Precautions.** Casualties have resulted from failure to comply with the safety precautions and operating instructions for the ejector. Frequent accidents have been caused by personnel pulling the safety pin before the signal is inserted in the signal ejector, then tripping the firing lever by forcing the signal into the ejector. The following rules should be carefully observed.

These signals should be inspected frequently. Any corrosion of the safety mechanism is reason for disposal in accordance with current BuOrd directives.

Do not remove the safety cotter pin until the signal has been pushed beyond the detent in the barrel of the ejector.

Stand clear of the breech while loading.

When handling signals, do not point either end directly toward personnel.

**General.** Submarine Float Signals Mk 2 Mods 0, 1, and 2 are for day use. They are similar in appearance and operation to submarine emergency identification signals, but do not project a grenade. They are ejected from the submarine signal ejector and, on rising to the surface, float, emitting either black or green smoke for about 15 seconds. The base of submarine float signals incorporates the same firing mechanism as submarine emergency identification signals. The closing cap is marked to show the color of the smoke. The delay train within the signals allows use from depths as great as 285 feet. Visibility in good weather is about 6 miles.

### Operation.

**PREPARING THE SIGNAL FOR FIRING.** Use the following procedure to prepare a signal for firing and to load a signal into the ejector.

1. Examine the signal to see that it has not been dropped; that the firing pin and tripping lever have not been forced, bent,



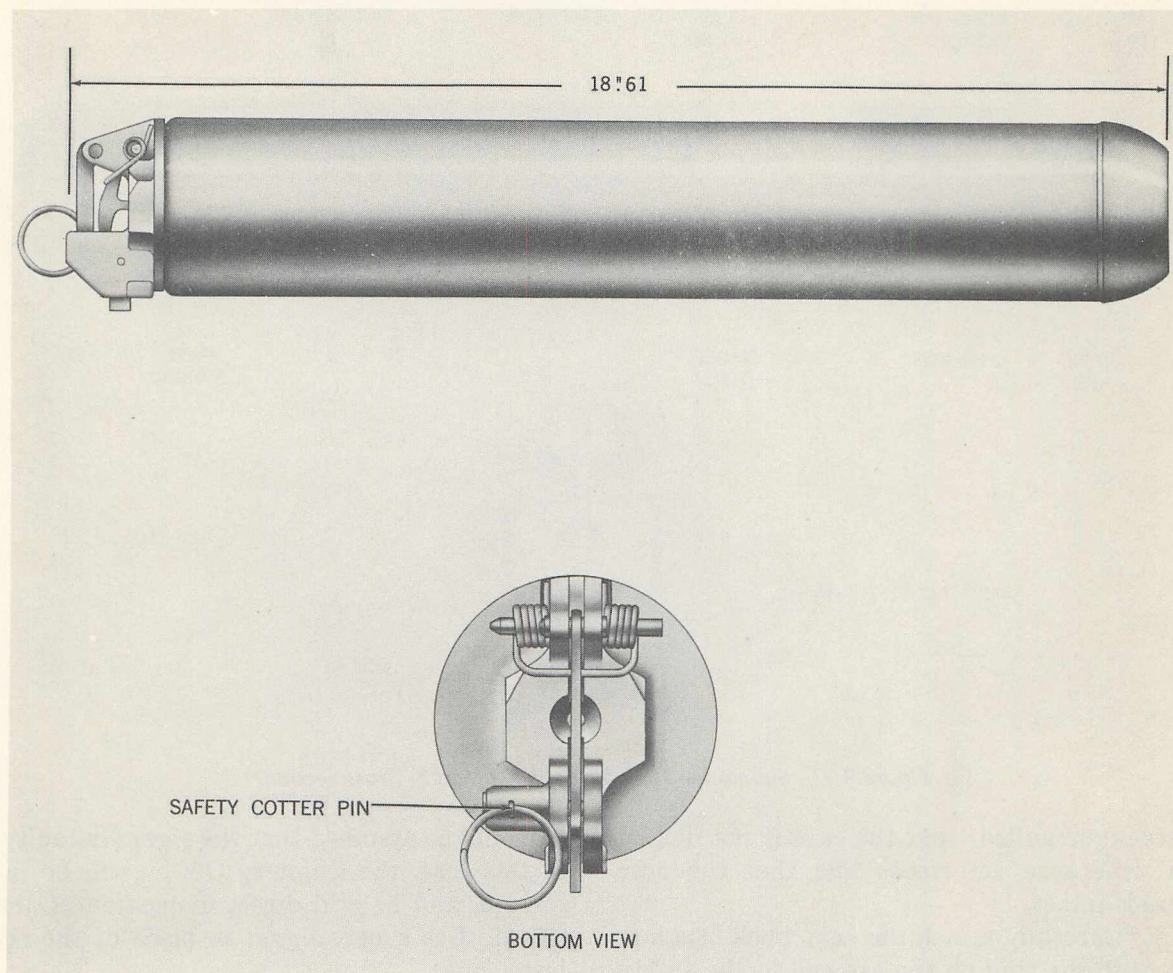


Figure 3.36—Submarine Float Signal Mk 2 Mod 2, External View.

### Submarine Float Signals Mk 2 Mods 0, 1, and 2

Mk	2	2	2
Mod	0	1	2
Drawing No.	344756		1305679
Diameter (in.)	3	3	3
Weight (lb)	3	3	3
Delay (sec)	46	46	46
Maximum Launching Depth (ft)	285	285	285
Shipping Container			
Number of Rounds	25, 6	25, 6	25, 6
Type	Wood, Metal	Wood, Metal	Wood, Metal
Weight (lb)	100, 37	100, 37	100, 37



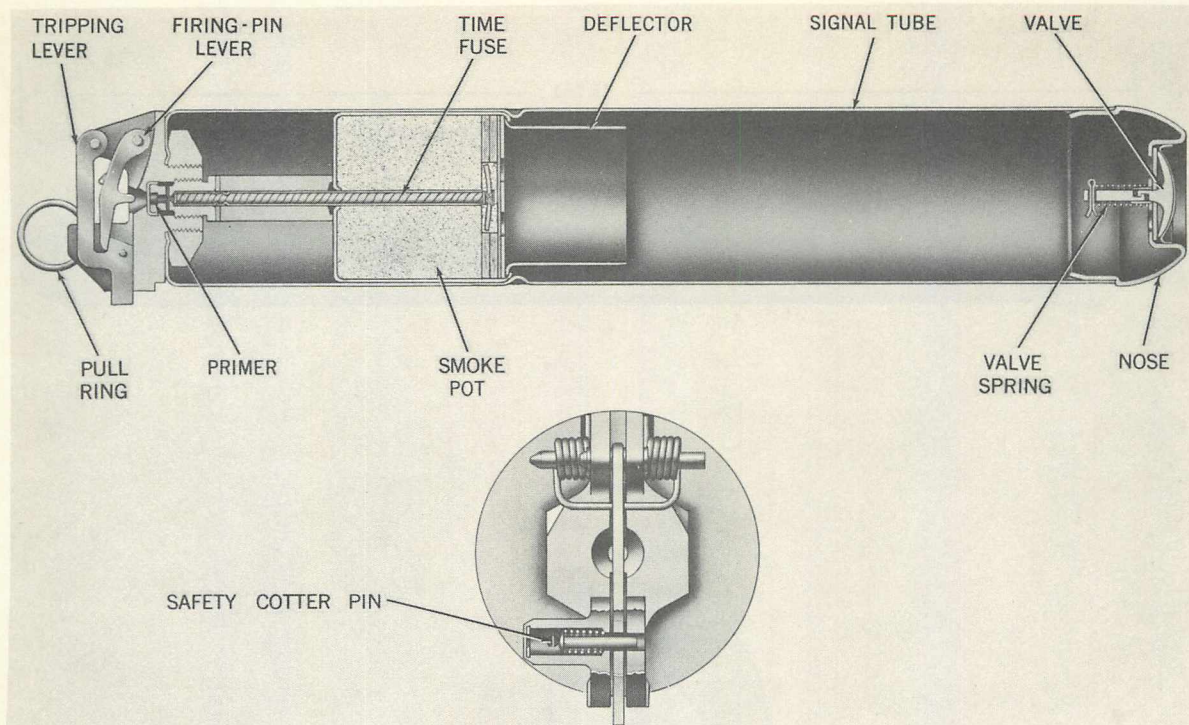


Figure 3.37—Submarine Float Signal Mk 2 Mod 2, Cross Section.

struck, or pulled; that the case is not dented or otherwise deformed; and that the nose seal is intact.

2. Carefully attach the snap hook of a lanyard to the ring on the eye end of the safety cotter pin.

#### WARNING

The safety pin should not be removed from the signal until the signal has been completely loaded. This is extremely important for personnel safety.

3. Load the signal in the barrel by pushing it forward toward the muzzle until the spring loaded detent drops down behind the signal.

4. While loading, pay particular attention to the following details.

a. Be sure that the lanyard does not foul, causing the pin to be pulled.

b. Use no force whatsoever when loading the signal.

c. If difficulty is encountered when loading a signal and no other cause is evident,

it should be assumed that the signal is faulty. In this case, the Gunnery Officer will be informed, and he will direct disposition of the signal. Use a new signal in place of the rejected one.

d. Even with the tripping groove clear, it may be possible for the tripping lever to catch at the point where the water-ejection and drain piping joins the ejector barrel.

e. Be sure that the guide of the signal is in the guide groove of the ejector. Early signals occasionally had short guides that were liable to leave the guide groove and cause the signal to bind in the ejector. All new production incorporates a higher guide.

5. With the signal in the loaded position and ready to be fired, withdraw the safety cotter pin with the lanyard by exerting a steady pull. Do not use a metal rod with a fork or hook for withdrawing the safety pin since this method will require more exposure of the body at the breech of the ejector.

#### WARNING

1. The safety cotter pin must not be



pulled until after the signal has been pushed beyond the detent and the breech door is about to be closed.

2. Personnel must keep clear of the breech of the signal ejector.

6. Close the breech door quickly and lock it shut. After the safety pin has been removed and the breech door closed, the muzzle door should be opened without delay. Proceed with the instructions found in the paragraphs dealing with firing procedures.

7. Whether or not attempts are made to fire, signals will not be removed from the ejector without authorization of the Commanding Officer. The procedure for removing signals is given further on in this section.

**FIRING THE SIGNAL EJECTOR HYDRAULICALLY.** To fire the signal hydraulically, proceed as follows.

1. Check to see that the muzzle door is closed, the drain open, and the vent open.

2. Build up air impulse to firing pressure. Use pressure 50 pounds greater than sea pressure. Cut air in to the signal gun.

3. Open the breech door of the ejector and examine for "bore clear." Use a flashlight. Be sure that the tripping groove is free of foreign matter all the way up to the tripping point.

4. Examine and load the signal.

5. Close the drain valve and breech door.

6. Flood the barrel from the sea, forcing air from the barrel through the vent line. When water escapes from the vent, close the vent and equalizer valve, and open the muzzle door.

7. Immediately prior to firing, verify that the impulse pressure exceeds the sea pressure by 50 pounds. If the submarine does not have sight glasses on the ejectors, proceed to steps 8 through 11. If sight glasses have been installed, proceed to steps 12 through 16.

8. Fire the ejector, holding the firing lever in the firing position for 5 seconds. Return the lever to neutral, wait 5 seconds, and then repeat the firing operation. In other words, the ejector should be fired twice for each signal. Next, pull the handle to the "Vent"

position to relieve pressure in the expulsion tank.

9. Leave the muzzle door open for a period of 2 minutes after firing. This is twice the duration of the time fuze of the signal. At the end of this safety period, shut the muzzle door; vent and drain the ejector.

10. On opening the breech door, keep all parts of the body out of line with the ejector barrel. Determine "bore clear" by means of a stiff ramrod which may be inserted without placing hands or other parts of the body in line with the ejector barrel.

11. If, on opening the breech door, a signal is found remaining in the barrel, the breech door shall be immediately closed, the ejector flooded, and the muzzle door opened. Additional attempts to fire may be made if so directed, but under no circumstances will the breech door be reopened in less than 10 minutes after the last firing attempt. See the paragraphs dealing with the removal of signals.

12. If sight glasses have been installed, fire the ejector, holding the firing lever in firing position for 5 seconds. Return the lever to neutral.

13. Determine by observation through sight glasses whether the signal has left the ejector. If the signal did not leave the ejector, wait 5 seconds and repeat the firing operation. If the signal still remains in the ejector, wait 10 minutes before attempting to remove it. See the paragraphs dealing with the removal of signals.

14. If the signal cleared the ejector, pull the handle to the "Vent" position to relieve the pressure in the expulsion tank.

15. No delay is necessary before closing the muzzle door and opening the breech door provided the signal is known to have been ejected as determined by observation through sight glasses.

16. Reload or secure the ejector.

**FIRING THE SIGNAL EJECTOR MANUALLY.** The following procedure for firing the signal gun with the ram will apply in most cases when manual operation of the signal gun is necessary.



1. Pull the ram all the way back; check to see that the muzzle door is closed; open the ram breech door.

2. Remove the breech door and ram. When the breech door is down and out of the way, load the signal.

3. Enter the ram behind the signal, and lock the special breech cover in place. This cover is constructed to permit operations of the interlock and rotation of the locking ring.

4. Close the drain valve and open the vent valve.

5. Open the equalizer valve and, when water escapes from the vent, close the vent and flood valves.

6. Open the muzzle door.

7. Push the projectile out by means of the ram.

8. Withdraw the ram at least 4 inches and close the muzzle door.

9. Open the vent and drain lines.

10. Unlock and open the breech cover, and withdraw the ram.

11. Reload or secure the ejector.

**REMOVING A SIGNAL BEFORE ATTEMPTING TO FIRE.** If no attempt has been made to fire and it is necessary to remove a signal from the ejector, the following procedure will be carried out carefully, upon authorization of the Commanding Officer.

1. Keeping the body out of line with the signal, remove the signal partially from the ejector until the primer can be inspected.

2. Inspect the primer to make sure it has not been fired. The exposed copper surface should be smooth and not dented.

3. If the primer has been fired or dented, replace the signal in the ejector, being careful not to trip the firing lever; close the breech door and the flood ejector and open the muzzle door as quickly as possible. Wait at least 10 minutes before removing the signal from the ejector in accordance with the procedure given in the paragraph "Removing a signal after attempting to fire."

4. If the primer has not been dented, remove the signal from the ejector, depress the jump-out pin, and insert the safety cotter pin. (The jumpout pin is in the boss from which the safety cotter pin was pulled.)

5. Dry the signal case.

6. Inspect the signal for damage which may have occurred during handling. Pay particular attention to the nose seal.

7. Tag the signal.

8. If damaged, lay the signal aside and dispose of it in accordance with current BuOrd instructions.

9. If serviceable, use the signal at the next opportunity.

**REMOVING A SIGNAL AFTER ATTEMPTING TO FIRE.** If a signal is discovered in the ejector after attempts to fire have been made, immediately close the breech door, flood the ejector, and open the muzzle door. (If the ejector has sight glasses, it will be unnecessary to open the breech door to determine whether the signal has left the ejector.) Wait at least 10 minutes after reflooding the ejector or after the last attempt to fire, if additional attempts to fire have been made, before opening the breech door. Carefully carry out the following procedure in removing the signal from the ejector.

1. Keeping the body out of line with the signal, remove the signal from the ejector.

2. Depress the jump-out pin and insert the safety cotter pin.

3. Tag the signal.

4. Lay the signal aside and dispose of it in accordance with current BuOrd instructions.

**Stowage.** The general rules for the stowage of pyrotechnics apply to submarine float signals.

**Safety Precautions.** Casualties have resulted from failure to comply with the safety precautions and operating instructions for the ejector. Frequent accidents have been caused by personnel pulling the safety pin before the signal is inserted in the signal ejector, then tripping the firing lever by forcing the signal into the ejector. The following rules should be carefully observed.

These signals should be inspected frequently. Any corrosion of the safety mechanism is reason for disposal in accordance with current BuOrd directives.

Do not remove the safety cotter pin until



the signal has been pushed beyond the detent in the barrel of the ejector.

Stand clear of the breech while loading.

When handling signals, do not point either end directly toward personnel.

**General.** Torpedo Float Signal Mk 21 Mod 1 is used to help locate a torpedo after a trial run. It produces both a flare and a smoke signal, and is therefore suitable for

either day or night use. The signal is launched from a gun-type ejector that is fitted into the exercise head of a torpedo. The signal will be described first, and a description of the gun-type ejector will follow.

The signal consists of a wood float with a cylindrical plastic cover. At one end is a firing mechanism that contains a firing pin and a percussion primer. The firing pin is held in the unarmed position by a cotter pin, to which a pull ring is attached. A flash hole leads from the primer to a delay fuse in the pyrotechnic subassembly. This subassembly is centrally located in a cavity in the wood float. It is supported at one end by a spacer ring and at the other by an end block. The end block is centrally drilled, and the hole

**Torpedo Float Signal Mk 21 Mod 1**

Mk	21
Mod	1
Drawing No.	SK 186486

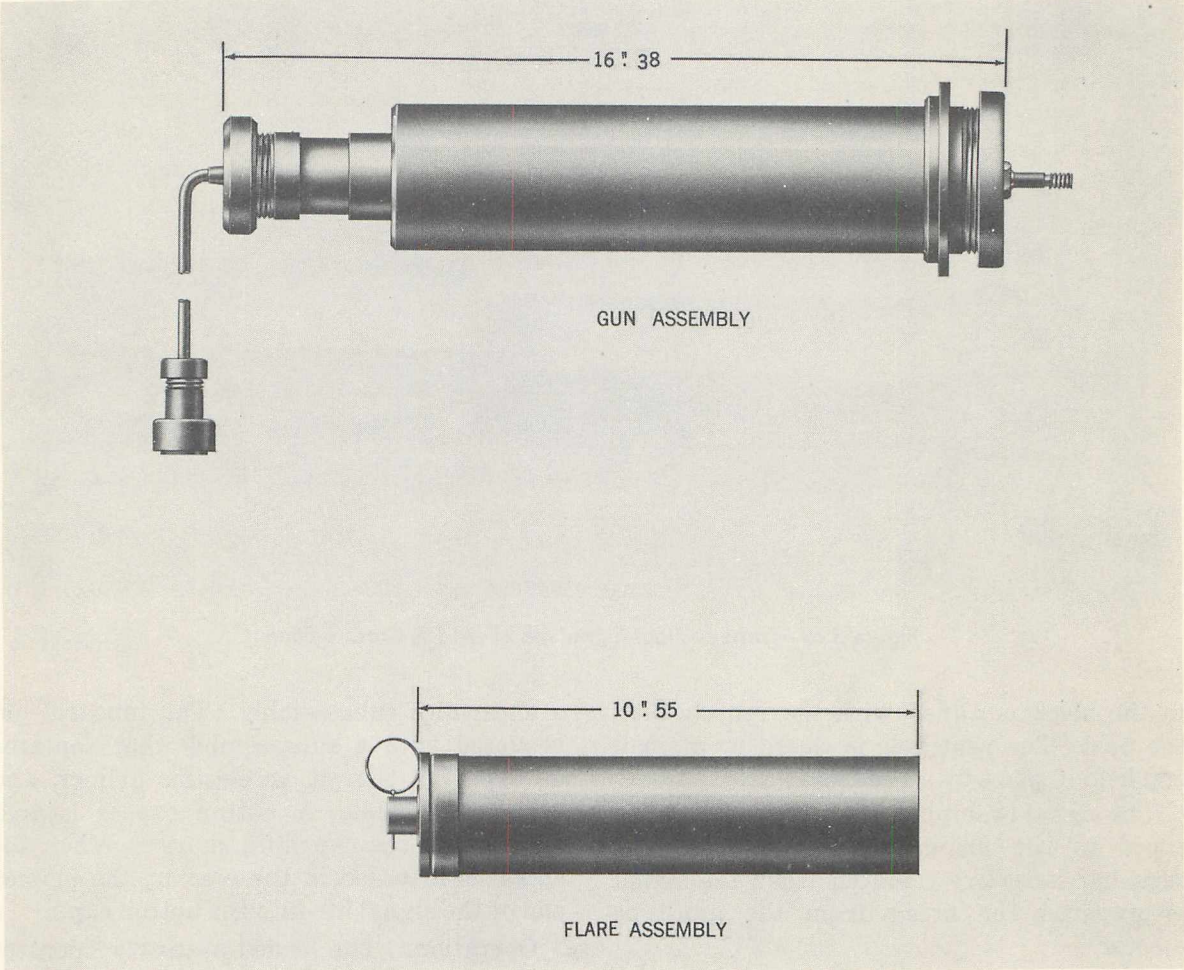


Figure 3.38—Torpedo Float Signal Mk 21 Mod 1, External View.



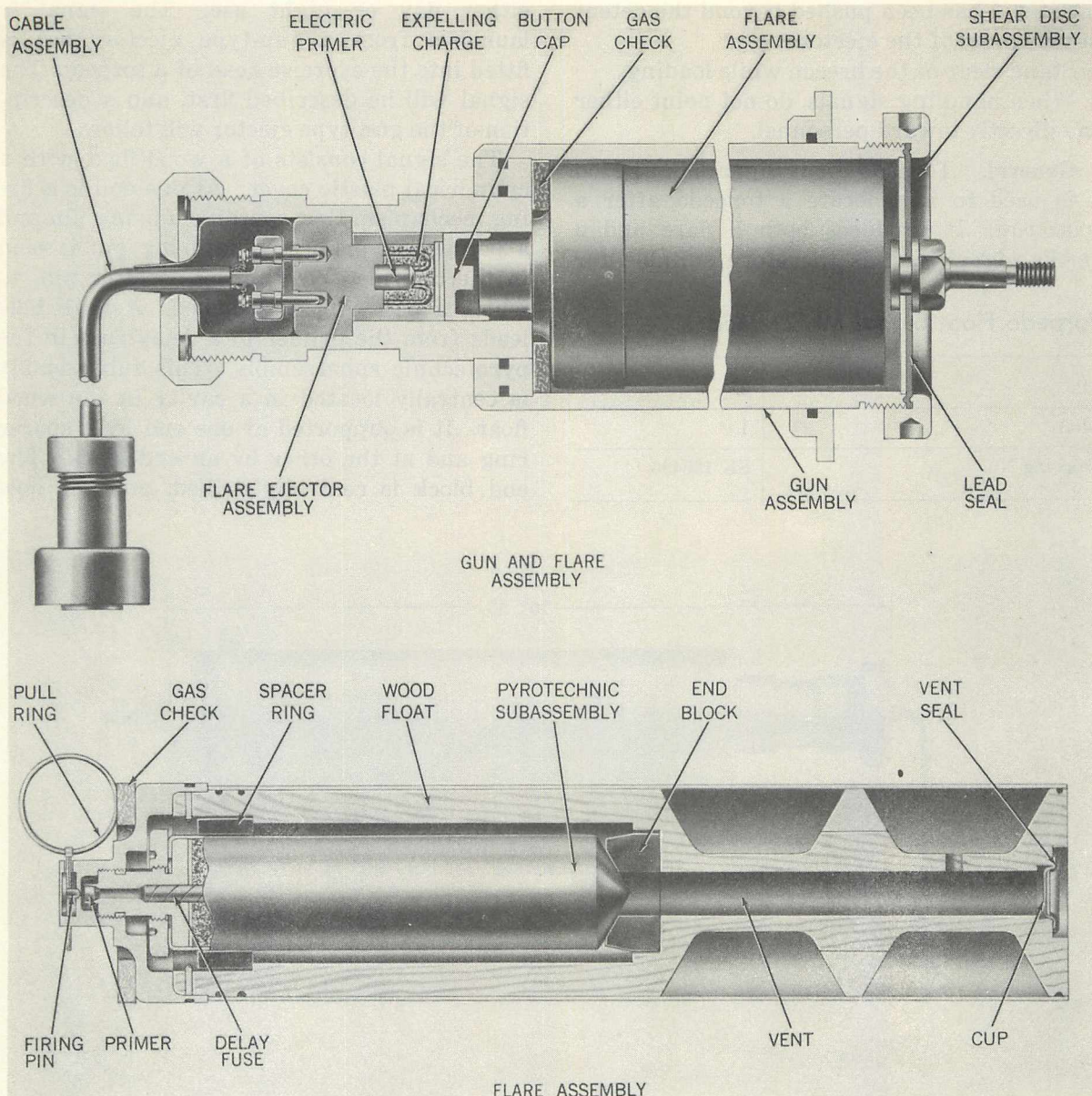


Figure 3.39—Torpedo Float Signal Mk 21 Mod 1, Cross Section.

in the block is aligned with the vent hole in the float. The vent hole is closed by a small cup held in place by a vent seal.

The signal is shipped with a gas-check ring taped to the firing mechanism end. The securing tapes are removed when the signal is prepared for firing from the gun-type ejector.

The ejector consists of a cylindrical tube. The outboard end of the tube is closed with

a shear-disc subassembly. The inboard end is closed with a subassembly that contains an expelling charge, an electric primer, and an electric cable. A button cap is located adjacent to the expelling charge. When the signal is installed in the ejector, the primer end of the signal fits into the button cap.

**Operation.** The loaded assembly operates as follows. An electric impulse from the torpedo electrical system explodes the ejector



primer which ignites the expelling charge. This pushes the button cap against the percussion primer in the end of the signal, igniting the delay fuse. At the same time the entire signal is pushed through the end of the ejector, shearing the lead disc. The shear-

disc subassembly is secured so that it will not be lost when the signal is fired. The signal rises to the surface. The delay fuse ignites the pyrotechnic composition of the candle. Expanding gases force off the vent seal and the signal emits flame and smoke.

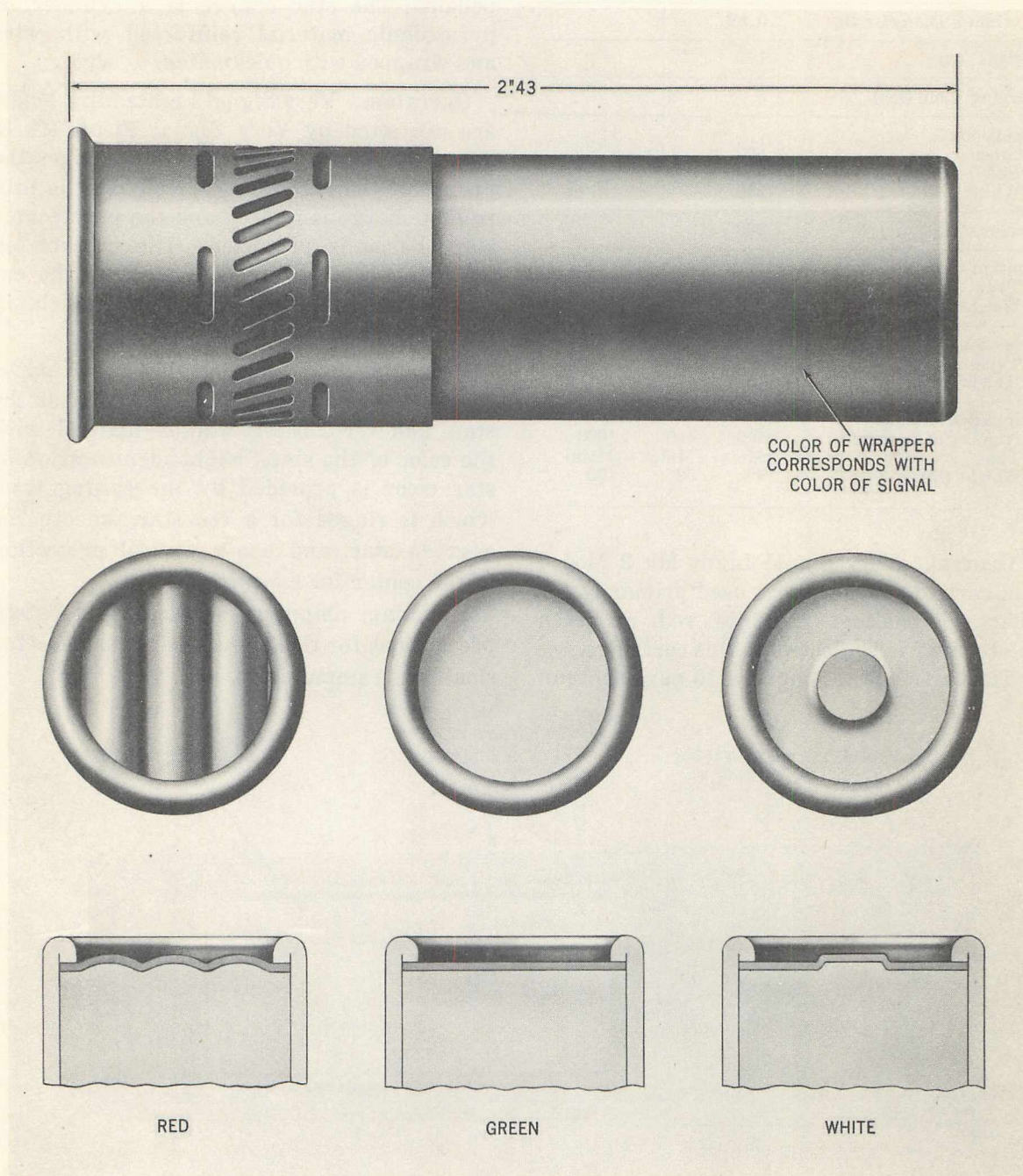


Figure 3.40—Very Signal Light Mk 2 Mod 0, External View.



## Very Signal Light Mk 2 Mod 0

Mk	2
Mod	0
Drawing No.	344562
Length (in.)	2.43
Maximum Diameter (in.)	0.88
Weight (oz)	1.1
Burning Time (sec)	6
Candlepower	
Green	600
Red	300
White	250
Height of Rise (ft)	200
Ignition Charge	
Type	Black powder
Weight (grains)	0.6
Propellant	
Type	Black powder
Weight (grains)	10
Shipping Container	
Number of Rounds	400      450      1000
Type	Metal    Metal    Metal
Weight (lb)	49        52        100

**General.** Very Signal Light Mk 2 Mod 0 is a cartridge-type signal used primarily for distress signaling. A white, red, or green colored star is projected by this cartridge.

The cartridge resembles a 10-gage shotgun

shell with the pyrotechnic star taking the place of the shot or projectile. The case, base, and primer are of commercial grade such as that used for shotgun shells, with a charge of black powder as the propellant. A hard felt wad protects the pyrotechnic star from the shock of the explosion of the propellant. The star charge is a cylinder of pyrotechnic material reinforced with wire and wrapped with quickmatch.

**Operation.** Very Signal Lights Mk 2 Mod 0 are projected by Very Signal Pistol Mk 5. When the firing pin of the pistol strikes the primer of the cartridge-type signal, the propelling charge is ignited and the pyrotechnic star charge is projected. The quickmatch wrapping of the star is ignited by the explosion of the propelling charge which, in turn, ignites the star.

**Packaging and Identification.** The paper case of the cartridge is the same color as the star, and the closing wad is marked with the color of the star. Night identification of star color is provided by the closing wad, which is ridged for a red star, smooth for a green star, and has a conical projection in the center for a white star.

Handling, shipping, stowage, and safety precautions for this signal are the same as for small arms ammunition.

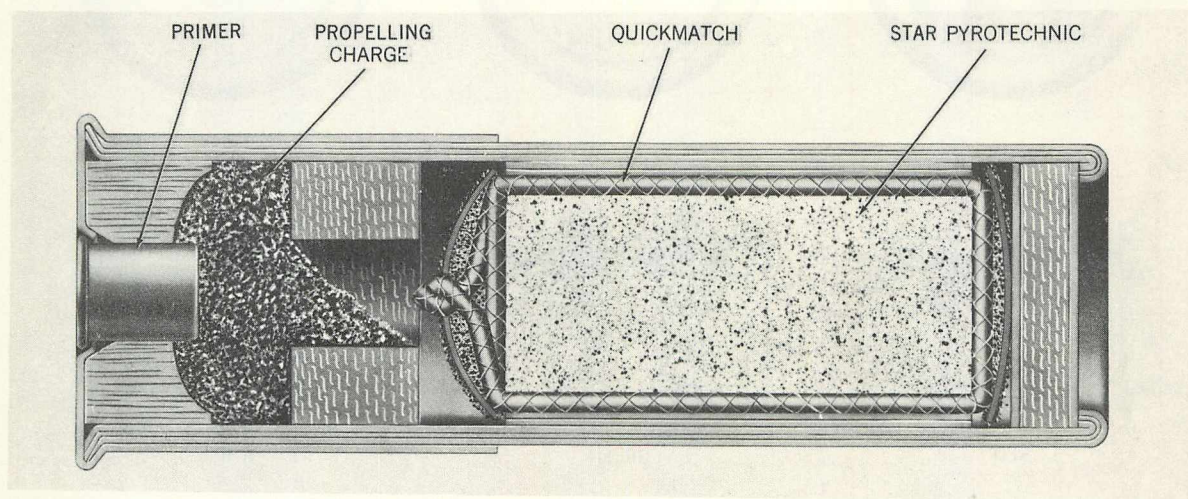


Figure 3.41—Very Signal Light Mk 2 Mod 0, Cross Section.



## One-Inch Salute Mk 1 Mod 0

Mk	1
Mod	0
Drawing No.	344600
Length (in.)	1.75
Diameter (in.)	0.75
Weight (oz)	0.25
Delay Fuze (sec)	3.5
Shipping Container	
Inner	
Number of Rounds	50
Type	Cardboard box
Weight (lb)	1
Outer	
Number of Rounds	500
Type	Wood box
Weight (lb)	20

**General.** The One-Inch Salute Mk 1 Mod 0 has been standardized for use by Marine Corps construction battalions and amphibious training commands. It is used in training to simulate actual battle sounds of a loud report and a bright flash. The One-Inch Sa-

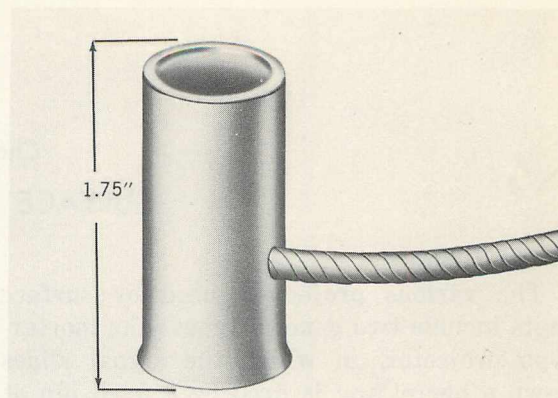


Figure 3.42—One-Inch Salute Mk 1 Mod 0.

lute Mk 1 Mod 0 is 1.75 inches long and 0.75 inch in diameter. It consists of a spirally wound paper tube, closed at both ends by strong paper cups which are pressed on and glued. The tube contains the salute charge, which is ignited by a 1.75-inch length of firecracker fuze inserted through the side of the tube and sealed with a suitable adhesive.



## Chapter 4

### SURFACE PROJECTORS

#### Introduction

The various projectors used by surface units include two general types: the mortar-type projector, in which the signal slides down a barrel and is fired by a fixed pin at the base; and the pistol-type projector, which is operated the same as any double-action single-shot pistol. All the pistols are breech loading; that is, the barrel is hinged so that the breech can be opened, and the cartridge-type signal is inserted from the breech end of the barrel. Pistols are fired by pulling the trigger with the index finger.

**Operation.** Since considerable recoil is encountered when firing pistol projectors, the elbow is bent slightly and the pistol is held firmly to absorb some of the recoil shock. If two hands are used to fire the pistol, the pistol is held in the usual manner, one hand is placed over the other, and the pistol is fired with both elbows slightly bent.

**Maintenance.** Projectors must be maintained in a serviceable condition by careful cleaning and oiling.

**Safety Precautions.** Pyrotechnic pistols should never be used for firing any ammunition except that especially designed for such use.

While loading, firing, or unloading a pyrotechnic pistol, the pistol must never be pointed toward personnel or craft.

If not fired, a pyrotechnic cartridge must always be unloaded immediately because, when the breech is closed, the pistol is in the cocked position.

In case of a misfire of a cartridge-type pyrotechnic, two more attempts will be made to fire the pistol. The breech may then be opened only after waiting at least 30 seconds to eliminate the possibility of a hangfire. The cartridge should be disposed of by being thrown overboard.

#### Projector Mk 13 Mod 0

**General.** Projector Mk 13 Mod 0 is used to project High Altitude Parachute Flare Mk 20. The projector consists of a steel tube or barrel which screws into a square steel base-plate. Four holes are drilled in the corners of the base so that it may be bolted to a boat deck or land base. In the center of the base is a stud with a hardened steel firing pin press-fitted into it. The stud is removable by the use of a socket wrench which is issued with the projector. There are three vent holes in the base plate to permit escape of air and allow a flare to drop freely down the barrel. A wrench is clamped to the lower end of the barrel so that the barrel may be removed for repairs or cleaning, and about 6 inches from the muzzle of the barrel are two holes opposite each other for the insertion of the release pin. The release pin has a 30-foot lanyard attached to it. A closing cap is screwed on the muzzle of the barrel when the projector is not in use.

Accessories packed in the box with the projector include two barrel wrenches, eight nuts, eight washers, four extra firing pins, two release pins, and two closing cap attachment chains.

**Operation.** The projector is operated by removing the closing cap and inserting the release pin in the holes provided for it. The lanyard should be handled carefully so that it does not become fouled and pull the release pin before personnel are clear of the area. The flare is removed from its container and inserted carefully into the muzzle of the projector until it rests on the release pin. The end of the flare containing the primer must be down and is easily identified by a copper cup. The projector is fired by pulling on the lanyard from behind a protective barrier. Pulling the lanyard removes the release pin



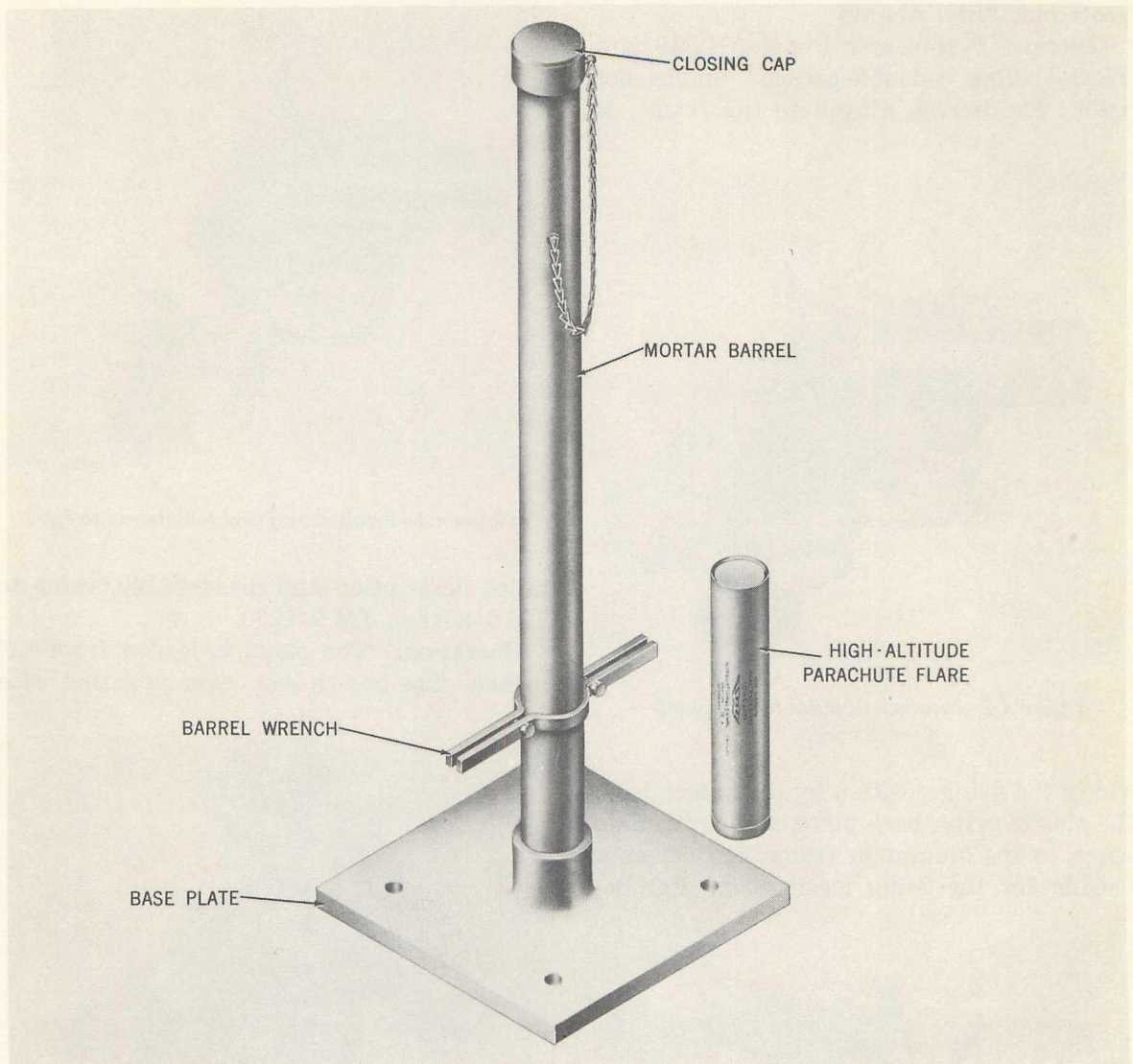


Figure 4.1—Projector Mk 13 Mod 0, External View.

and allows the flare to slide down the barrel until the primer strikes the firing pin.

**Maintenance.** Misfires may be caused by a defective primer or a weak impact of the primer on the firing pin. The barrel must be kept clean at all times; if a deposit from a previous firing is present it must be removed by swabbing the barrel with acetone or approved solvent. The barrel wrench is used to unscrew the barrel from the base to facilitate cleaning. The base of the projector must be kept clear and the vent holes must be open. Any chips from previous rounds which re-

main in the base must be removed because the chips may prevent the next round from striking the firing pin with enough force to fire the primer. In case of a misfire, the barrel must be unscrewed from the base to remove the round.

**Safety Precautions.** A suitable barrier should be erected to shield personnel firing the projector.

The projector must be fastened securely to the deck or other support.

If a flare misfires, personnel must wait 3 minutes before approaching the projector.



### Pyrotechnic Pistol AN-M8

**General.** Pyrotechnic Pistol AN-M8 is a breech-loading, double-action, single-shot pistol. The barrel, hinged to the frame, is



Figure 4.2—Pyrotechnic Pistol M8, Tripping Breech Lock.

held in the firing position by the breech lock. The plastic grips, back plate, and cover plate fasten to the aluminum frame and act as a housing for the firing mechanism. For de-



Figure 4.3—Pyrotechnic Pistol M8, Loading.

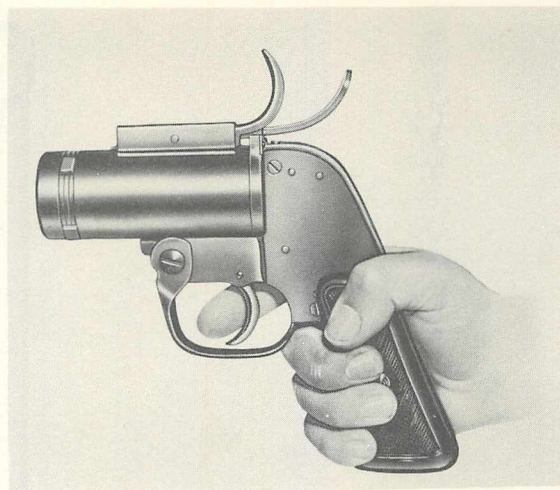


Figure 4.4—Pyrotechnic Pistol M8, Ready to Fire.

tailed description and disassembly, refer to TM 9-2018 or TM 9-1290.

**Operation.** The pistol is loaded from the breech. The breech lock lever is raised with

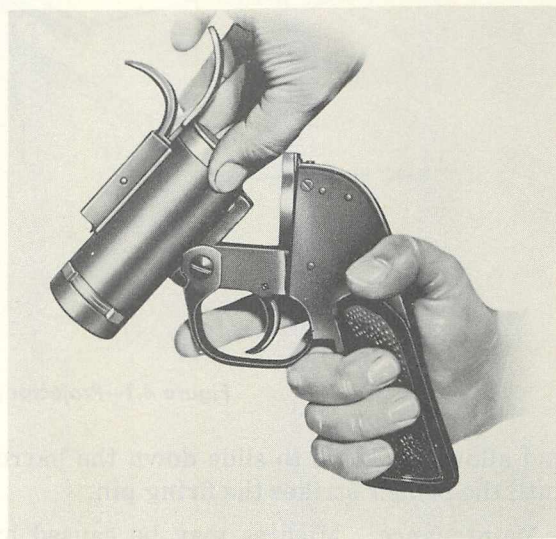


Figure 4.5—Pyrotechnic Pistol M8, Extracting Shell.

the thumb, allowing the breech to open. A signal is inserted in the chamber. The grip is then pulled upward, the breech lock engages; and the pistol is ready for firing. Since the pistol is always cocked when the breech lock is engaged, firing is accomplished by pulling the trigger.



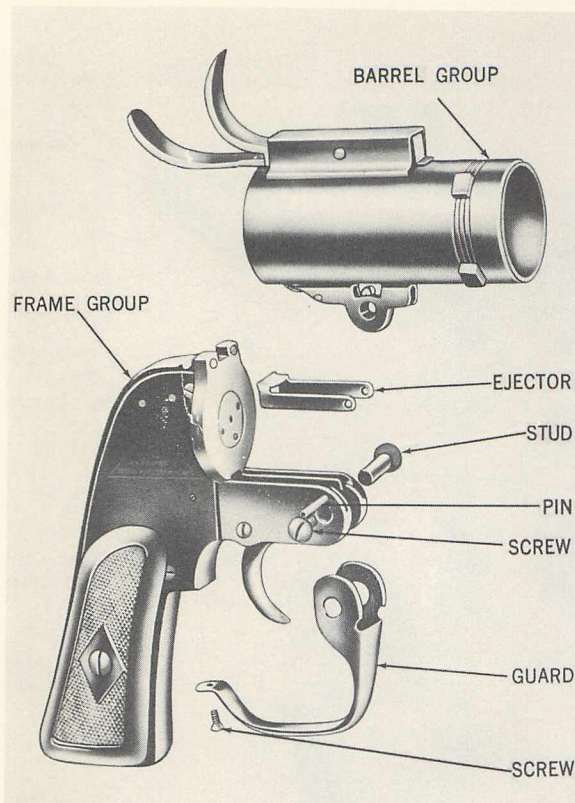


Figure 4.6—Pyrotechnic Pistol M8, Disassembled.

To remove the empty signal, the pistol is opened as it was for loading. As the breech opens, the ejector moves the empty signal rearward a short distance until it can be removed by hand. The pistol is then closed until reloading is desired.

**Maintenance.** Maintenance of the pistol is simple and a minimum of field care is required. It should be kept clean by wiping parts with a clean cloth free of lint. A few drops of machine gun oil on the moving parts at intervals will suffice for lubrication. Powder residue may be removed by acetone or an approved solvent. In the event of breakage of any parts, if spare parts are not available, a new pistol should be requisitioned and the damaged pistol turned in.

**Safety Precautions.** Since the pistol is cocked at all times when the breech is closed, a live signal must never be left in the pistol.

Place signal in pistol only when immediate use is anticipated.

Other precautions concerning pistols listed in the first part of this chapter shall be strictly observed.

#### Rocket Signal Pistol Mk 1 Mod 0

**General.** Rocket Signal Pistol Mk 1 Mod 0 is a breechloading, double-action, single-shot pistol. It is used for the projection of pistol rocket signals only. The pistol consists of three main assemblies: the barrel, the breech, and the grip. The barrel is made of light die-cast metal and is hinged to the breech for loading. It includes a hinge cam which operates the cartridge ejector. The breech is also die-cast of light-weight metal and includes the breech latch and lock. The grip is of molded bakelite and contains the metal parts of the firing mechanism, which are held in place by the tang nut.

**Operation.** The pistol is operated by pushing on the breech lock with the thumb, opening the breech by a downward pressure on the end of the barrel, inserting a pistol rocket signal, closing the breech by an upward pressure on the barrel, and firing by pulling the trigger.

**Maintenance.** The pistol should be kept clean by wiping parts with a clean cloth free of lint. A few drops of machinegun oil on the moving parts at intervals will suffice for lubrication. Powder residue may be removed by acetone or an approved solvent. In the event of a breakage of any of the parts, a new pistol should be requisitioned and the damaged pistol turned in to an ammunition depot for repair.

**Safety Precautions.** Since the pistol is cocked at all times when the breech is closed, a live signal must never be left in the pistol. Place signal in pistol only when immediate use is anticipated.

Other precautions concerning pistols listed in the first part of this chapter shall be strictly observed.



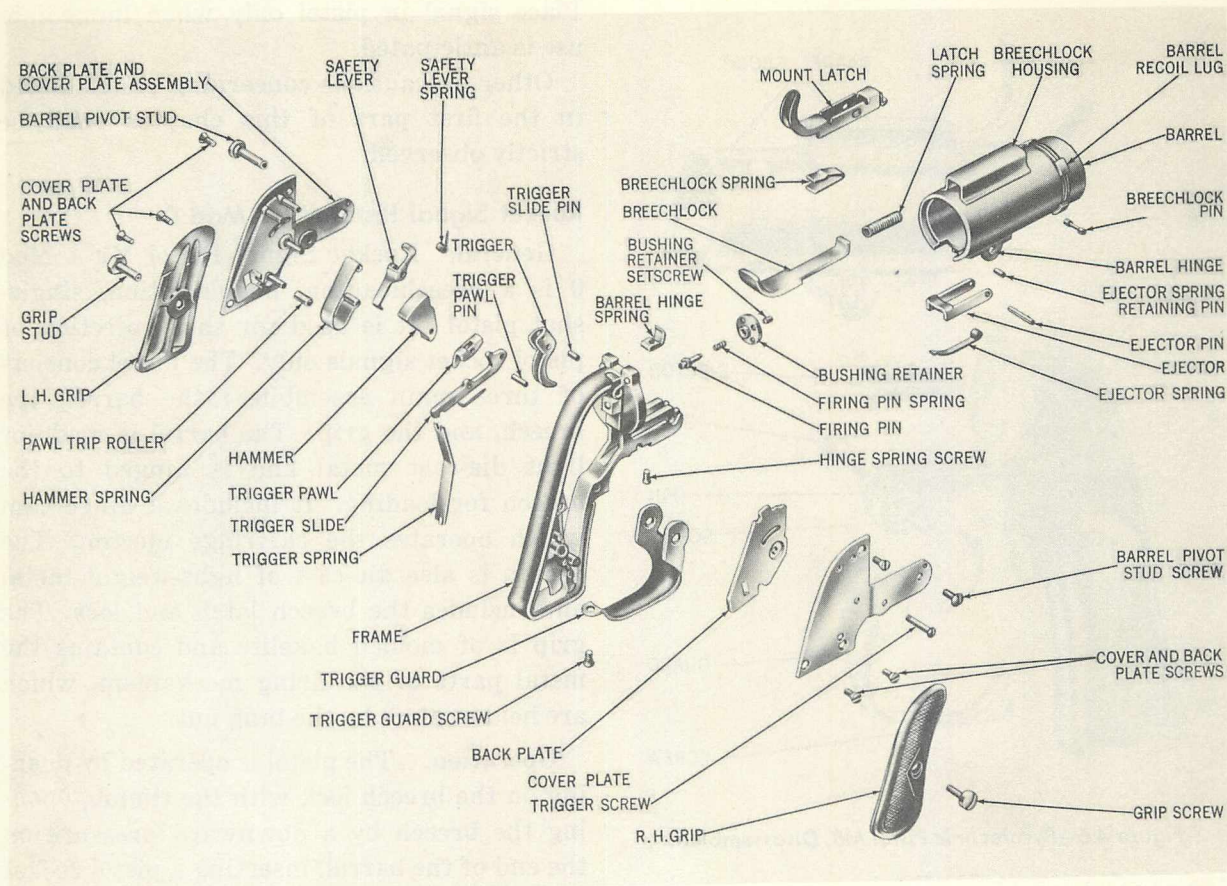


Figure 4.7—Pyrotechnic Pistol M8, Exploded View.

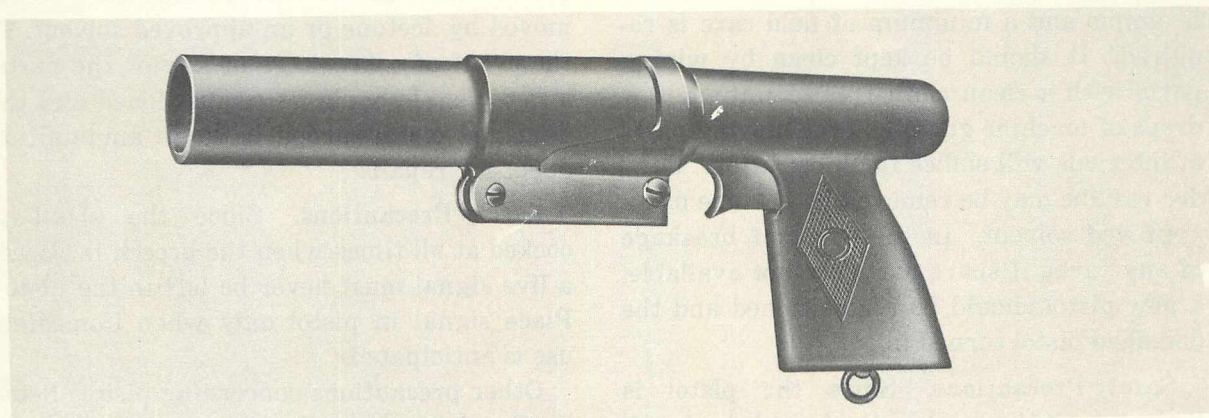


Figure 4.8—Rocket Signal Pistol Mk 1 Mod 0, External View.



### Very Signal Pistol Mk 5 Mod 0

**General.** Very Signal Pistol Mk 5 Mod 0 is used to project Very Light Mk 2. It is a single-barrel, double-action, breech-loading pistol, consisting of a plastic frame on which are mounted the metal parts of the pistol. Cartridge Belt Mk 1 and Holster Mk 5 are used for carrying the pistol and a supply of shells.

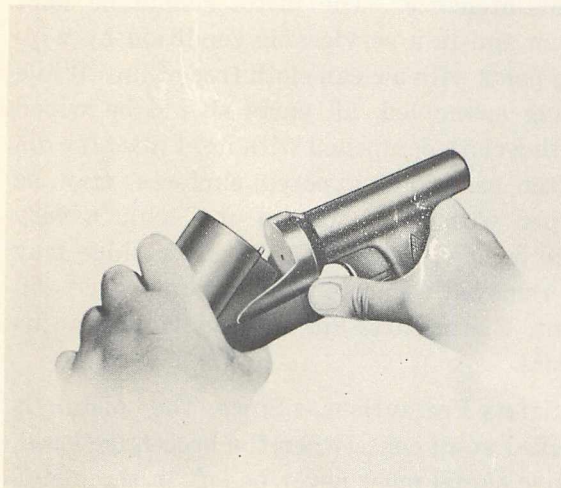


Figure 4.9—Rocket Signal Pistol Mk 1 Mod 0, Opening Breech.

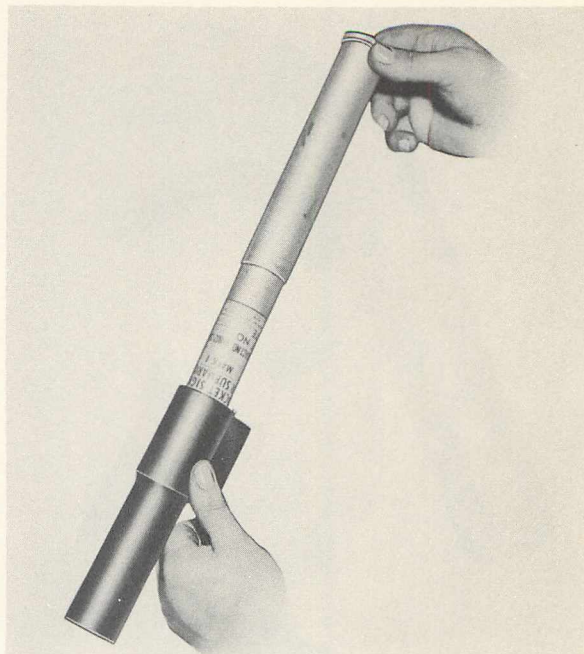


Figure 4.10—Rocket Signal Pistol Mk 1 Mod 0, Loading.

**Operation.** To open the breech, push the latch pin located at the bottom of the barrel just forward of the trigger, and push down

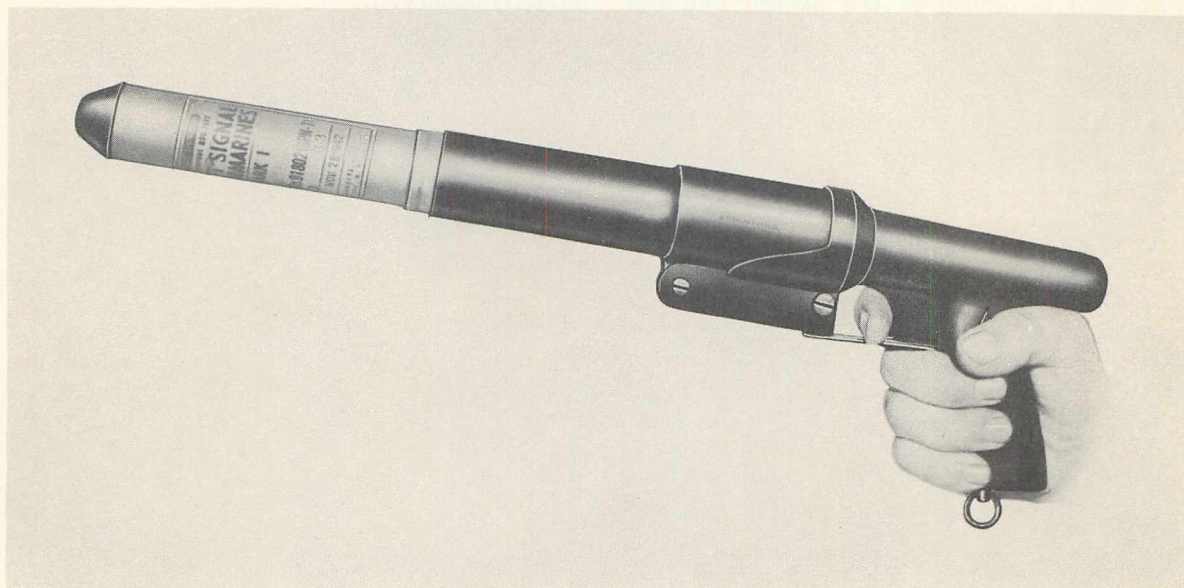


Figure 4.11—Rocket Signal Pistol Mk 1 Mod 0, Ready to Fire.





Figure 4.12—Rocket Signal Pistol Mk 1 Mod 0,  
Extracting Shell.

on the muzzle end of the barrel. A signal light shell is placed in the breech and the

breech is closed by pushing up on the end of the barrel. The pistol is fired by pointing in the desired direction and pulling the trigger. Being double-action, the trigger cocks the firing pin and then releases it. The expended shell is removed by opening the breech and removing the shell, which has been partially pushed out of the breech by the extractor.

**Maintenance.** The pistol should be kept clean and in a serviceable condition by wiping parts with a clean cloth free of lint. While being assembled, all parts should be wiped with a cloth dampened with light machine oil. After assembly, exposed surfaces may be wiped with a clean cloth until only a very thin layer of oil is left. Powder residue may be removed by acetone or any approved solvent. Spare parts kits are available for this pistol.

**Safety Precautions.** Since the pistol is cocked at all times when the breech is closed, a live signal must never be left in the pistol. Place signal in pistol only when immediate use is anticipated.

Other precautions concerning pistols listed in the first part of this chapter shall be strictly observed.



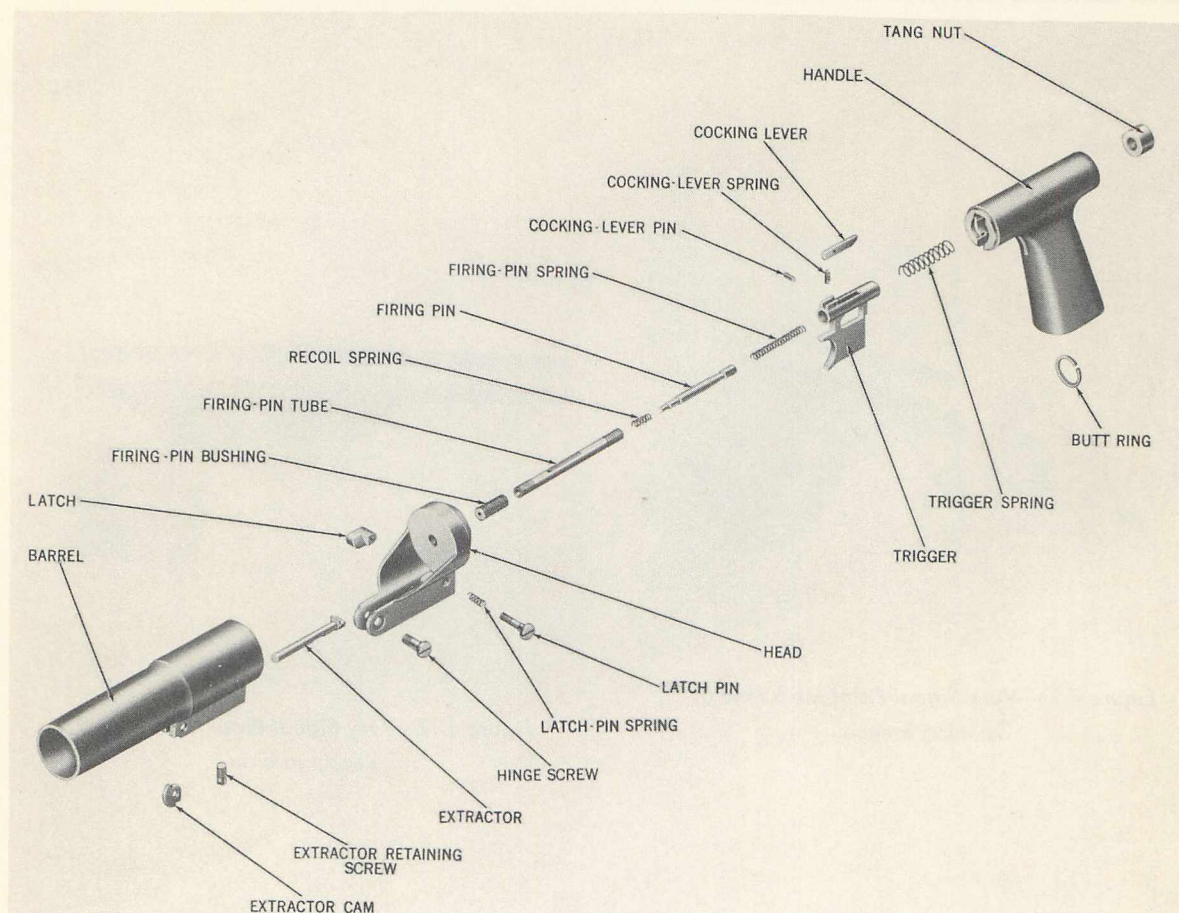


Figure 4.13—Rocket Signal Pistol Mk 1 Mod 0, Exploded View.

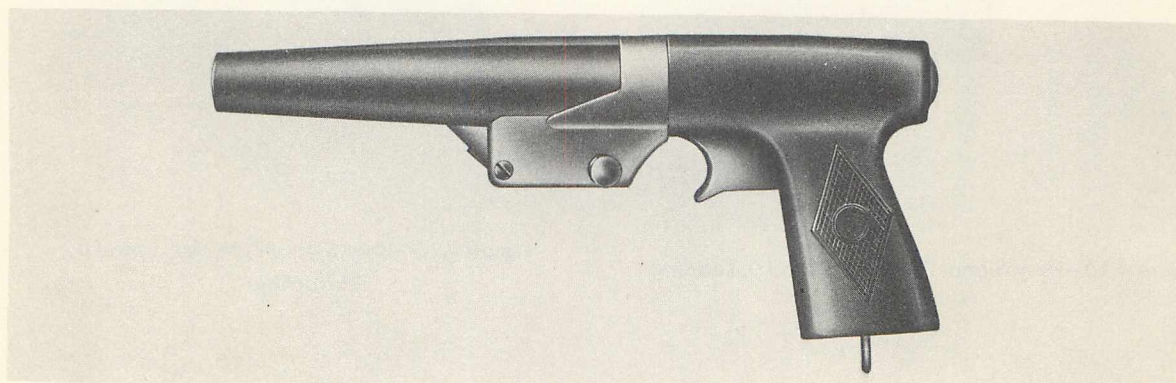
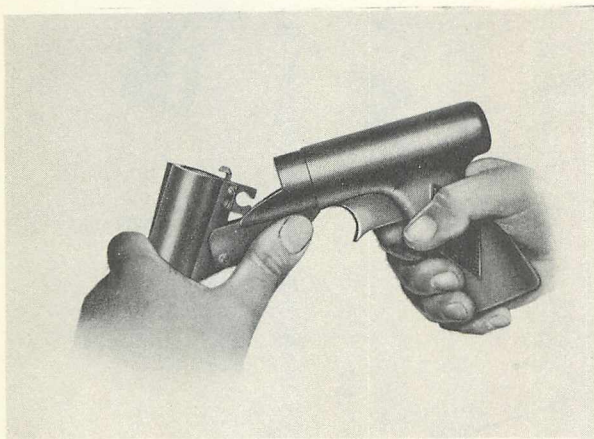
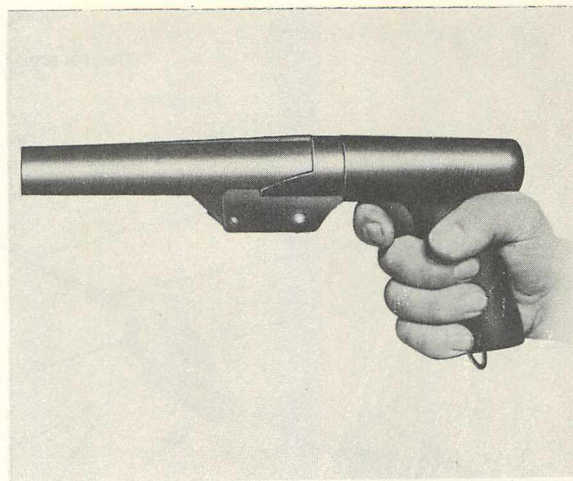


Figure 4.14—Very Signal Pistol Mk 5 Mod 0, Exploded View.

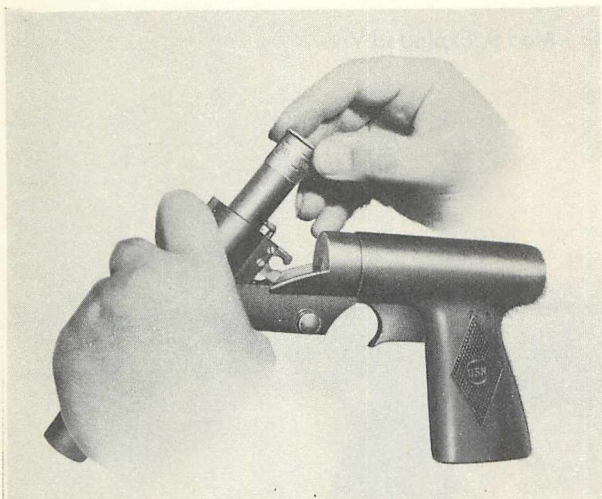




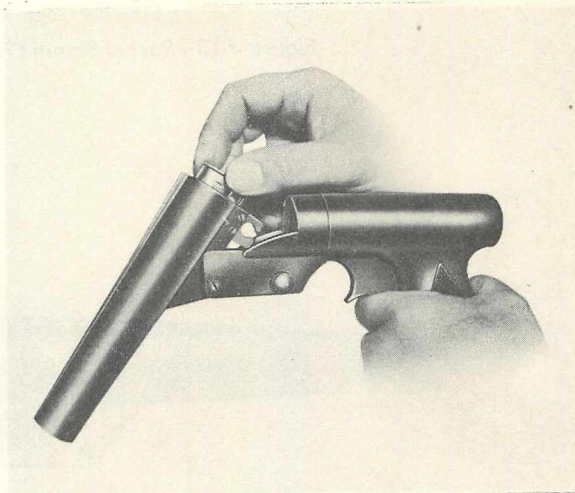
*Figure 4.15—Very Signal Pistol Mk 5 Mod 0,  
Opening Breech.*



*Figure 4.17—Very Signal Pistol Mk 5 Mod 0,  
Ready to Fire.*



*Figure 4.16—Very Signal Pistol Mk 5 Mod 0, Loading.*



*Figure 4.18—Very Signal Pistol Mk 5 Mod 0,  
Extracting.*



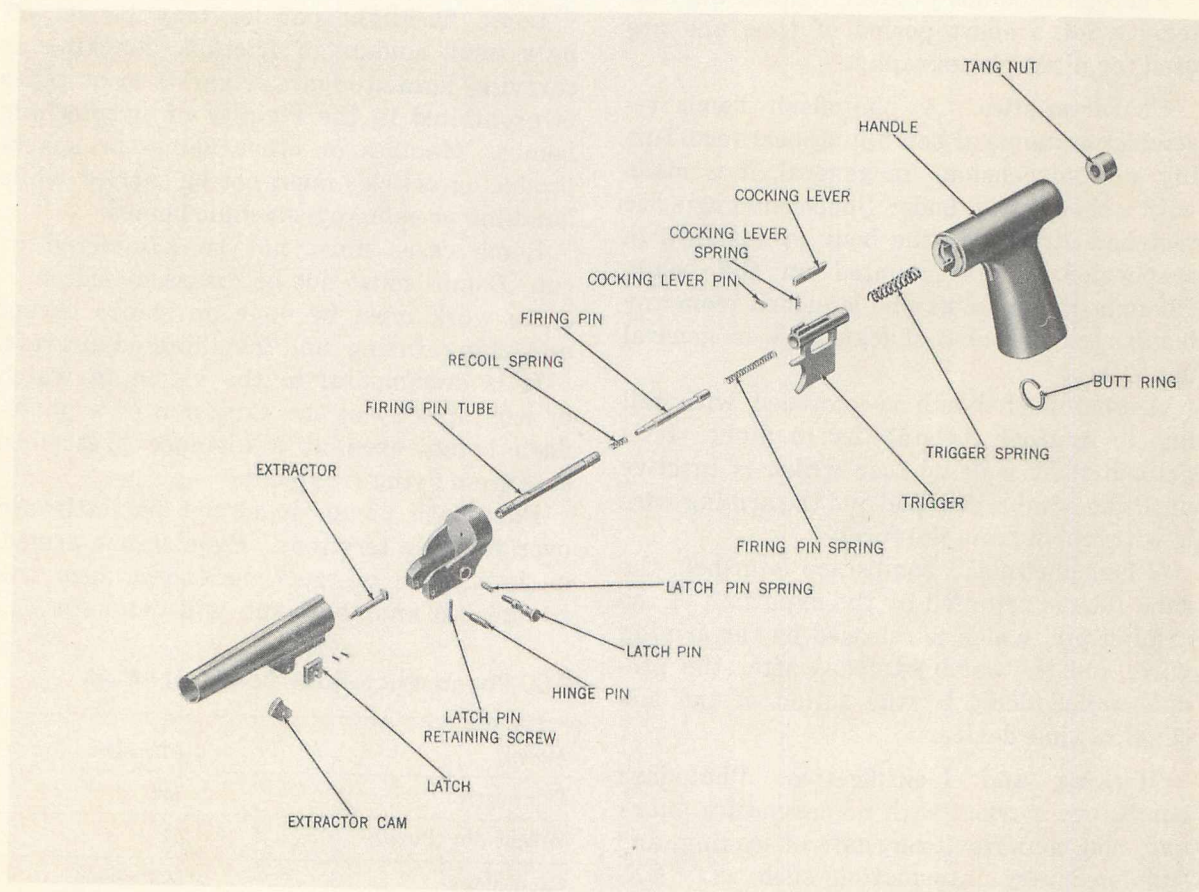


Figure 4.19—Very Signal Pistol Mk 5 Mod 0, Exploded View.



## Chapter 5

### PHOTOFLASH BOMBS

#### Introduction

Photoflash bombs produce light of high intensity for a short period of time and are used for night photography.

**Characteristics.** A photoflash bomb resembles a standard bomb in appearance, fuzing, and suspension. In general, it is made with a sheet-metal body. Suspension lugs are fastened directly to the body or fastened to suspension bands mounted on the bomb. Photoflash bombs may be launched from any bomb rack or bomb shackle now in general use.

A photoflash bomb is provided with tail fins to improve its stability in flight. It is detonated by a delay fuze which is inactive until the bomb is dropped and the arming wire is withdrawn from the fuze.

When photoflash bombs are launched, the time fuze is actuated by the expulsion of the arming pin, which is released by the arming wire, and the bomb explodes after the predetermined delay by the action of the mechanical time device.

**Marking and Identification.** Photoflash bombs are marked with nomenclature, mark and mod, manufacturer, date of loading, and supplementary information such as: "EXPLOSIVE BOMB" or "PARACHUTE END."

**Handling and Stowage.** Photoflash bombs and their explosive components such as burster tubes and fuzes must be handled and stowed in accordance with OP 4 and OP 5.

**Disposal.** Duds and unserviceable photoflash bombs will be disposed of in accordance with OP 5 or other current Bureau of Ordnance directive.

**General Safety Precautions.** Photoflash bombs must be handled with the same care as black powder since they explode with

great violence and heat. Sparks or friction will easily ignite them.

Loose flashlight powder may be set off by a small amount of friction. Smoking or carrying lighted cigars, cigarettes, or pipes is prohibited in the vicinity of pyrotechnic bombs. Matches or other flame- or spark-producing articles must not be carried while handling or using pyrotechnic bombs.

Bomb cases must not be hammered or cut. Bombs must not be disassembled.

No work must be done on bombs except unpacking, fuzing, and installing on aircraft.

It is detrimental to the vision to watch or look directly at the explosion of a photoflash bomb, even at a distance prescribed safe from flying fragments.

Photoflash bombs must not be jettisoned over friendly territory. Even if not armed, on impact all obstructions in the fuze will be sheared and the bomb will detonate.

#### 100-Pound Photoflash Bomb AN-M46

Model	AN-M46
Drawing No.	339776
Weight (lb) (Fuzed)	51.9
Candlepower	500 million
Delay (sec)	5 to 92
Minimum Release Altitude (ft)	7500
Burning Time (sec)	0.20
Ignition Charge Type Weight (oz)	Black powder 0.53
Illuminant Type Weight (lb)	Flashlight powder 25
Shipping Container Number of Rounds Type Weight (lb)	1 Wood box 79



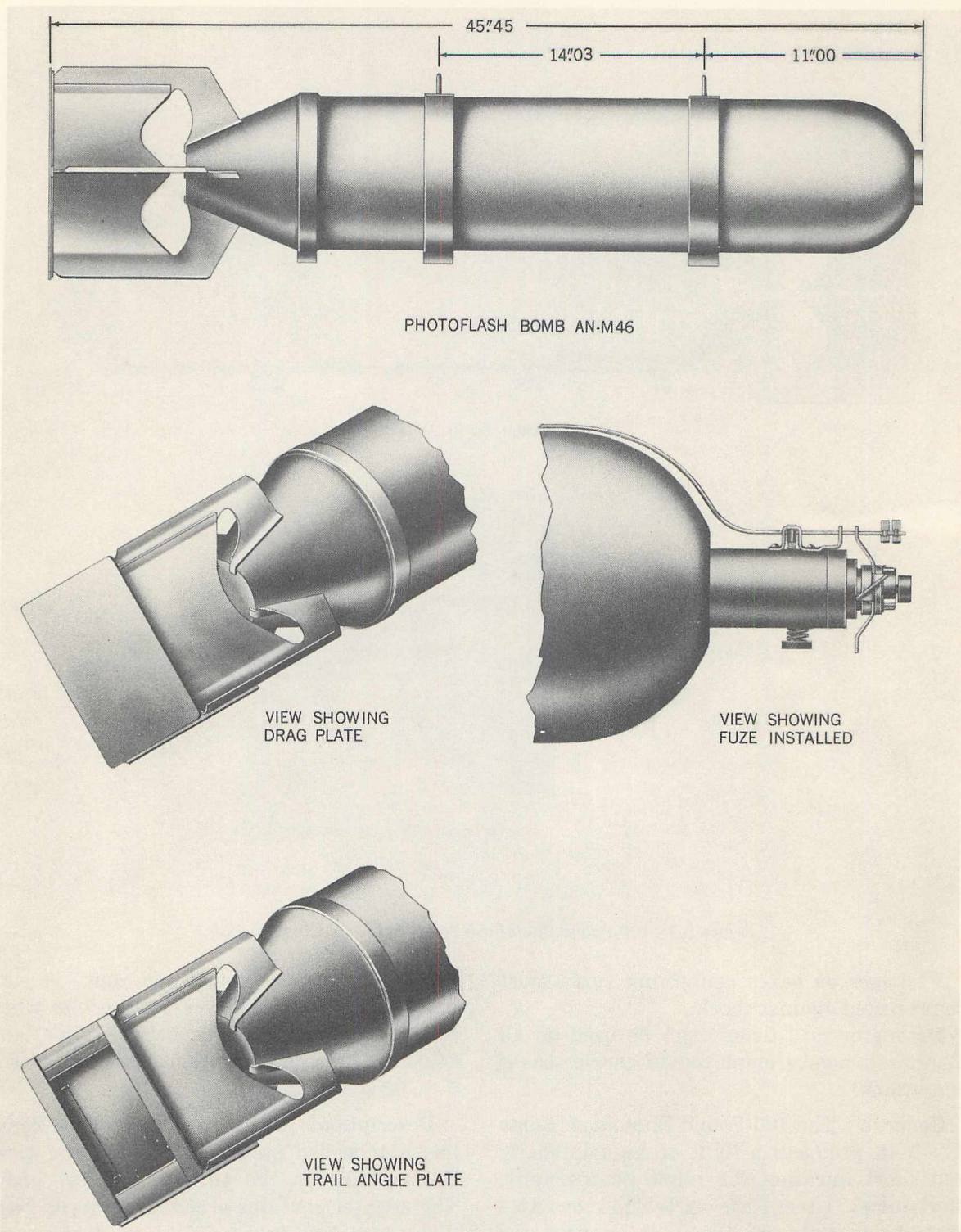


Figure 5.1—100-Pound Photoflash Bomb AN-M46, External View.



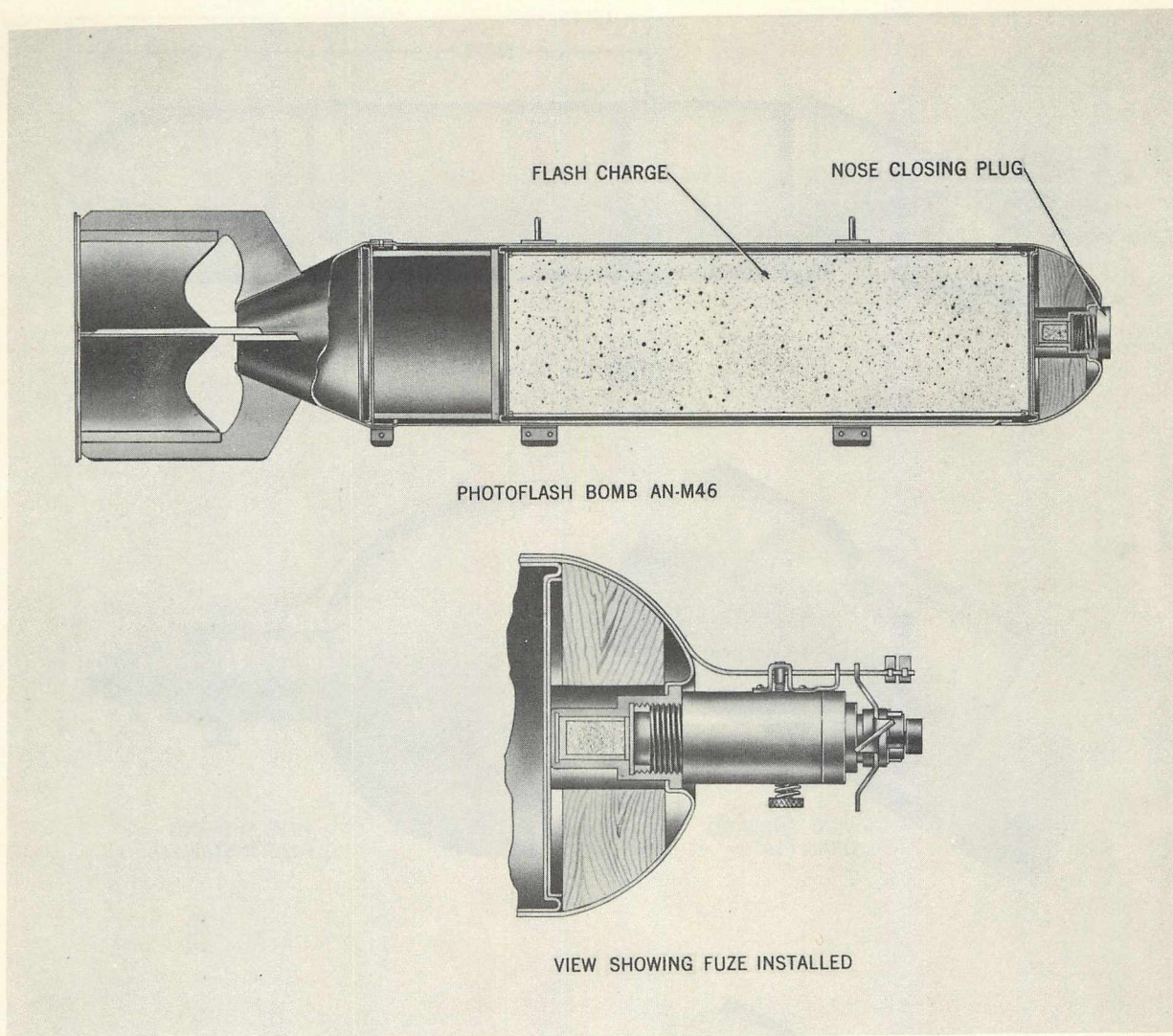


Figure 5.2—100-Pound Photoflash Bomb AN-M46, Cross Section.

Packages or boxes containing fuzes must be protected against shock.

Detonator-safe fuzes must be used on all photoflash bombs employed in carrier-based operations.

**General.** The 100-Pound Photoflash Bomb AN-M46 produces a light of high intensity and short duration for night photography. Mechanical Time Fuse AN-M146 or AN-M146A1 permits this bomb to be used for high-altitude photography. The AN-M46 Bomb differs from the M46 Bomb only in details of the suspension lugs.

As issued, the bomb is assembled with

fins and suspension bands but is unfuzed. The bomb achieves best results when dropped from an altitude between 7500 and 25,000 feet, with appropriate setting of the 5- to 92-second delay fuze.

**Description.** The nose section of the bomb has a threaded steel adapter for the time fuze welded to the thin gage steel body. The adapter contains a metal cup in its base filled with 145 grains of black powder. A closing plug is assembled in the nose of the adapter. A wood nose block is located inside the nose and surrounds the adapter assembly. Behind this is a cardboard container



with 25 pounds of uncompressed photographic flashlight powder. The black sealing strip for this container has identification markings in white ink. The top of the container is closed with a thin metal disc, and the bottom with a sheet-metal terneplate. The container does not fill the entire bomb body, but is held forward in place by filler, spacers, and a plywood supporting disc. The fin and trail-angle-plate assembly is spot welded or riveted to the fin cone. The cone is connected to the rear end of the bomb body by means of three slotted grooves that fit around corresponding riveted lugs on the bomb body; it is held in place by the fastening band.

Attached across the back of the fin is the flat trail-angle plate, held in place by two  $\frac{1}{4}$ -inch carriage bolts running through the fins. The trail-angle plate may be removed when replacement with two trail angles is desired. The arming wire is contained in an envelope and packed in the same box with the bomb.

The bomb may be released safe or armed. If released safe, it may function on impact. If armed, it functions as follows. On release from the plane, the arming wire is withdrawn from the fuze, which starts to operate. The fuze arms within a few seconds and then operates at the time set. The fuze booster is initiated and this sets off the charge in the adapter booster charge which, in turn, ignites the photoflash powder charge.

**INSTALLATION AND REMOVAL OF FUZE.** Refer to chapter 6 for installation and removal instructions for the fuze.

**MODIFICATION OF TRAIL PLATE.** Photoflash Bomb AN-M46 is issued with a full size trail plate or drag plate covering the entire rear surface of the tail. To meet various photographic conditions, the trail angle of the bomb may be varied by modifications to the trail plate.

The modification consists of removing the plate entirely or cutting out the center of the plate, leaving angles on two sides. A section approximately 8 inches by  $5\frac{7}{8}$  inches

is removed by hacksaw, cutting torch, or cold chisel and the cut surfaces are smoothed by file or abrasive. The two  $\frac{1}{4}$ -inch by  $6\frac{1}{2}$ -inch carriage bolts are replaced by four  $\frac{1}{4}$ -inch 20-NC standard hex bolts  $\frac{1}{2}$ -inch long. Two  $\frac{1}{4}$ -inch 20-NC hex nuts and two  $\frac{1}{4}$ -inch lockwashers are needed, together with the nuts and lockwashers removed from the carriage bolts. If longer bolts are used, there will be an increase in the trail angle.

**Safety Precautions.** In addition to the precautions given in the introductory section of this chapter, the following will be observed.

A photoflash bomb which is dropped safe, or one in which the fuze fails to function, will probably detonate on impact. Any bomb that does not detonate on impact will be treated as a dud and destroyed in accordance with current instructions.

Because of the brilliance of the flash, it is detrimental to vision to watch the explosion of photoflash bombs, even at distances prescribed as safe from bomb fragments.

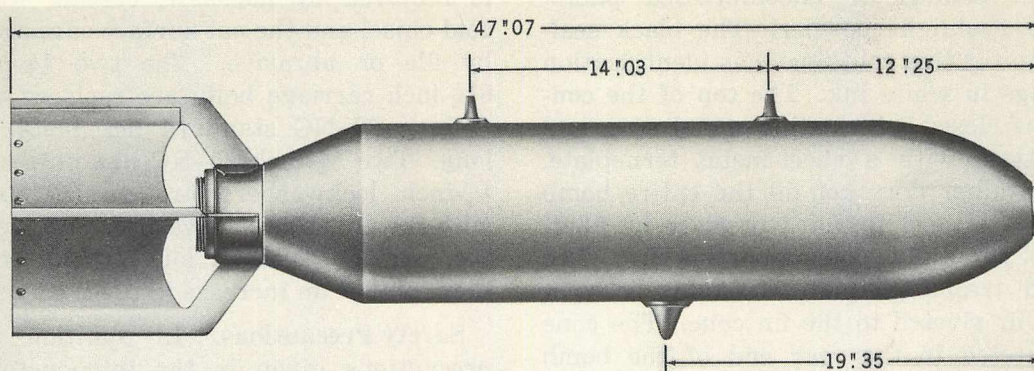
No modifications to the trail plate will be made without first removing the trail plate from the bomb body. Machining or welding operations on the trail plate must comply with the safety requirements of OP 5.

If loose flashlight powder is discovered in the fuze cavity at any time, the loose powder must be removed and the bomb disposed of in accordance with current regulations.

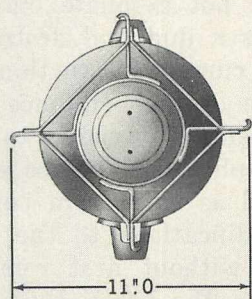
**General.** Photoflash Bombs M120 and M120A1 have been developed for night photographic missions at altitudes up to 30,000 feet. They develop a peak intensity of approximately 3 billion candlepower in 0.004 second. These bombs have greater candlepower and greater resistance to bullet and flak penetration than the Photoflash Bomb AN-M46, which they are designed to replace.

The M120-type bombs require Mechanical Time Fuze M146 or M146A1. If the bomb is assembled with Fin Assembly M125A1, it is called Photoflash Bomb M120; if it is assembled with Fin Assembly M127, it is called Photoflash Bomb M120A1.

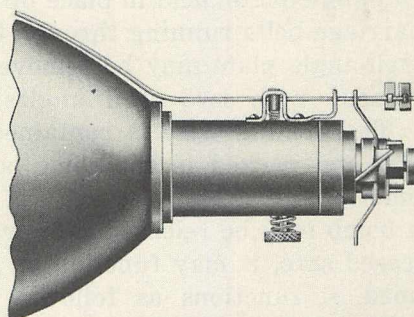




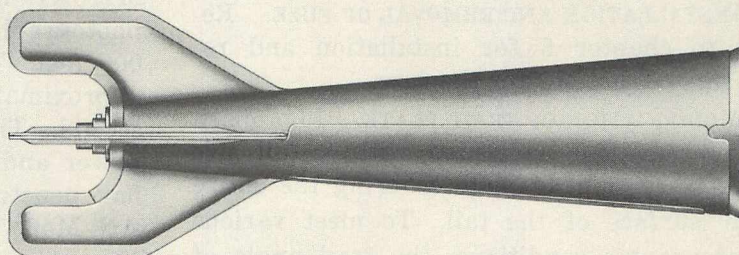
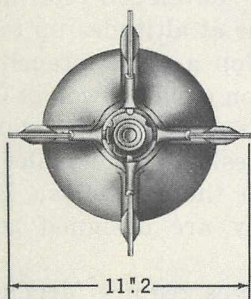
PHOTOFLASH BOMB M120



FIN ASSEMBLY M125A1  
USED ON PHOTOFLASH BOMB M120



VIEW SHOWING FUZE  
INSTALLED



FIN ASSEMBLY M127 USED ON PHOTOFLASH BOMB M120A1

Figure 5.3—Photoflash Bombs M120 and M120A1, External View.



## Photoflash Bombs M120 and M120A1

Model	M120	M120A1
Drawing No.	78-0-133	78-0-131
Length (in.)	47.07	65.3
Weight (lb) Shipping Fuze	155 147	155 160
Candlepower	3 billion	3 billion
Delay (sec)	0.2	0.2
Minimum Release Altitude (ft)	As directed for mission	
Burning Time (sec)	0.004	0.004
Booster Type Weight (lb)	Black powder 0.25	Black powder 0.25
Illuminant Type Weight (lb)	Photoflash powder 69	Photoflash powder 69
Packing Data Bomb, with Shipping Bands, without Fin Assembly (lb)	155	155
Fin Assembly Number per Container	8	1
Type of Container	Wood	Wood
Weight (lb)	67	80
Arming Wire Number per Container	400	400
Type of Container	Wood	Wood
Weight (lb)	80	80

**Description.** Photoflash Bomb M120 is cylindrical, 39.66 inches long exclusive of fin and fuze, and 8.00 inches in diameter. The average wall thickness of the case is 0.19 inch. As shipped, the loaded bomb weighs 155 pounds and contains 69 pounds of photoflash powder. A booster bag of 0.25 pound of black powder is assembled within a steel housing assembly in the nose cavity.

The choice of fin assembly to be used with the bomb is dependent upon such considerations as altitude of release, speed of aircraft, desired trail angle, and height of burst.

Fin Assembly M125A1 is a modified AN-M103A1 box-type fin assembly. The modification, which consists of three holes on each side of the fin box, is provided to permit assembly of a trail plate or trail angles. Trail Plate Kit M42A1, or Trail Angle Kit M43, is usually required with this fin assembly.

Fin Assembly M127 is a conical-type fin assembly. It consists of a coupling tube with

setscrews, a cone assembly, and a fin locknut with setscrews.

AN-M6A2, arming wire, a single branch wire 57 inches long and 0.064 inch in diameter, is authorized for use with Photoflash Bomb M120. Fuze AN-M146A1 is used in this bomb. It is a mechanical time fuze of the detonator-safe, long-arming, long-timing range type.

Trail Plate Kit M42A1 contains an 8-inch square trail plate, an 8-inch circular spoiler ring, and four screws for attaching the trail plate to the fin. The spoiler ring, when used, is held in place by the fuze. Thus the trail plate and, in addition, the spoiler ring, may be used, when required, to produce the drag necessary to obtain the desired trajectory of the bomb.

Trail Angle Kit M43 contains 3 pairs of trail angles, each pair having a different width of flange (1-inch,  $\frac{1}{2}$ -inch, and  $\frac{1}{4}$ -inch) and 12 screws, nuts, and lockwashers for attaching trail angles to the fin.



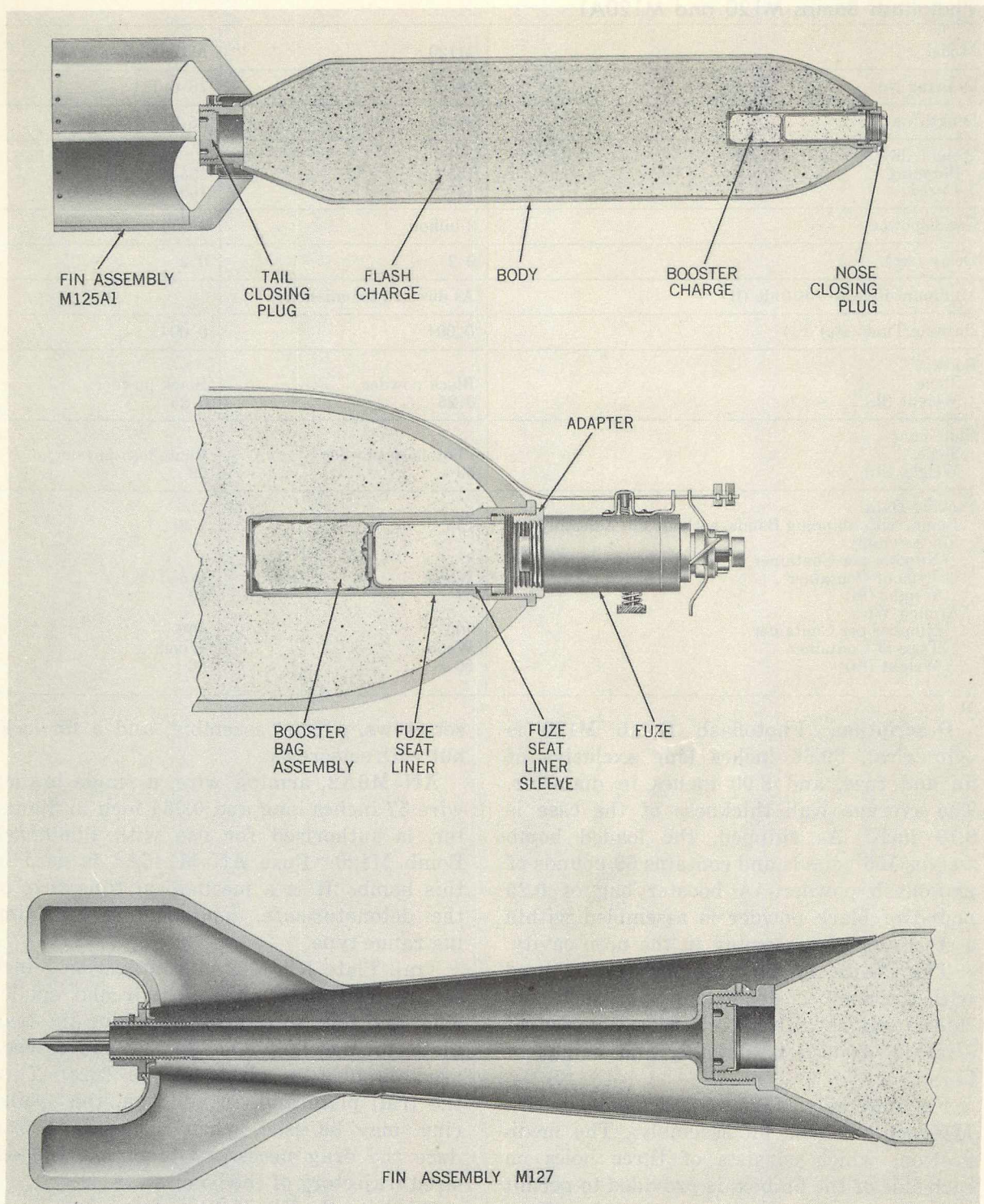


Figure 5.4—Photoflash Bombs M120 and M120A1, Cross Section.



**Assembly.****BOMB WITH M125A1 FIN ASSEMBLY.**

1. Remove the fin assembly from its packing container.

2. Remove the trail plate kit or trail angle kit from its packing container.

3. Fit the trail plate, or trail angles, over the fin box so that one ear rests on the outside of each side of the fin box.

4. Aline the holes in the trail plate ears with the center hole in each side of the fin box.

5. Using the screws issued with the kit, securely fasten the trail plate to the fin assembly.

6. If the trail angles are to be used instead of the trail plate, the selected pair should be connected to opposite sides of the fin box, using the screws issued with the kit. The two outer holes on the sides of the fin box will aline with the holes in the trail angles. The webs of the trail angles are attached to the outer sides of the fin box and the flanges extend out over the sides of the fin box.

7. Remove the shipping bands, fin locknut clip, protector, and fin locknut from the bomb.

8. Place the fin in position on the bomb and assemble the fin locknut.

9. When the bomb is to be carried internally, aline one of the fin blades with the suspension lugs. If the bomb is to be carried in external suspension, the blades of the fin assembly must be alined at an angle of 45 degrees to the suspension lugs.

10. Tighten the locknut with the fin locknut wrench.

11. Refer to chapter 6 for installation and removal instructions for the fuze.

**BOMB WITH M127 FIN ASSEMBLY.**

1. Remove the shipping bands, fin lock clip, protector, and fin locknut from the bomb.

2. Remove the fin assembly from its packing.

3. Screw the coupling tube assembly onto the base plug of the bomb and tighten securely, using a bar or rod passed through

the two holes provided in the coupling tube; then tighten the three setscrews in the cupped end of the coupling tube.

4. Place the fin assembly over the coupling tube. When the bomb is to be carried internally, aline one of the fin blades with the suspension lugs. If the bomb is to be carried in external suspension, the blades of the fin assembly must be alined at an angle of 45 degrees to the suspension lugs.

**NOTE:** The fin web is an integral part of the fin cone assembly.

5. Screw the fin locknut onto the threaded end of the coupling tube until it seats tightly against the fin web.

6. Bend two of the tabs on the fin web into two of the slots provided in the fin locknut.

7. Tighten securely the three setscrews on the fin locknut.

8. Refer to chapter 6 for installation and removal instructions for the fuze.

**Disassembly.** If the bomb is not dropped, replace the cotter pin in the fuze arming pin, replace the striker stop between the striker and safety block, pass the seal wire through the eyelets in the vane tab and arming wire guide, and fasten the ends of the wire together. Then remove the arming wire and unscrew the fuze. Replace the closing plug in the bomb. Return the fuze to its original packings and seal with adhesive tape.

After defuzing, remove the fin and return the bomb and fin to their original condition and packing. This procedure applies to rounds fitted with either M125A1 or M127 fin assemblies.

**Safety Precautions.** Photoflash bombs must be handled with particular care at all times. Damaged bombs will be disposed of in accordance with instructions contained in OP 5.

Photoflash bombs and fuzes should be stowed in a dry, well-ventilated place, out of the direct rays of the sun, and protected against excessive temperatures, as directed in OP 5.

Do not remove protective or safety devices from fuzes until just before use. Do not



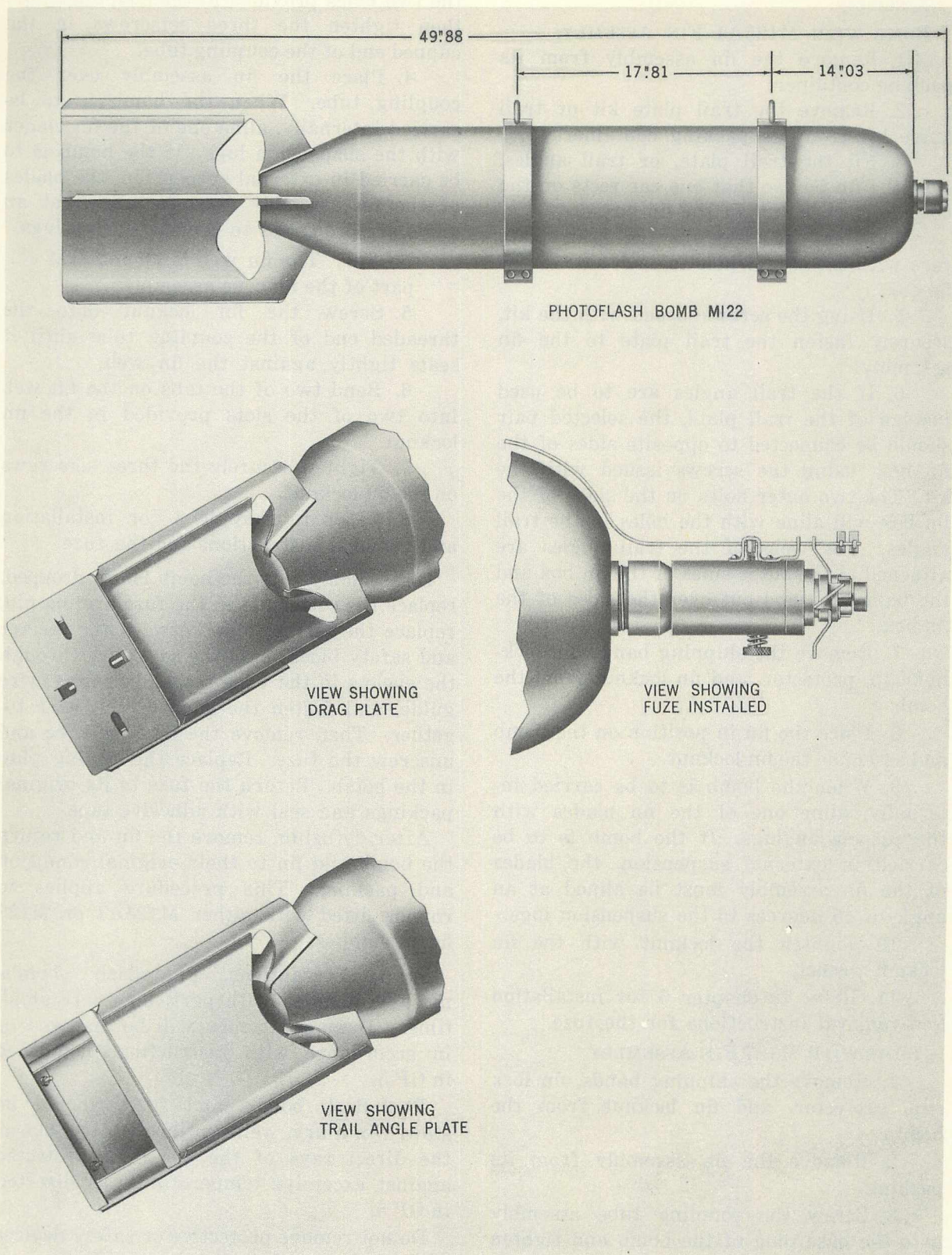


Figure 5.5—Photoflash Bomb M122, External View.



attempt to disassemble any fuze.

A photoflash bomb which is dropped safe, or one in which the fuze fails to function, will probably detonate on impact. Any bomb that does not detonate on impact must be treated as a dud and be destroyed in accordance with the instructions contained in OP 5.

Because of the brilliance of the flash, it is detrimental to vision to watch the explosion of photoflash bombs, even at distances prescribed as safe from bomb fragments.

### Photoflash Bomb M122

Model	M122
Drawing No.	78-0-135
Weight (lb) Shipping Fuzed	103 107
Candlepower	45 million
Delay (sec)	0.2
Minimum Release Altitude (ft)	As directed for mission
Burning Time (sec)	0.004
Burster Charge Type Weight (lb)	M26 1.9 (70/30) tritonal 0.1 tetryl pellets
Illuminant Type Weight (lb)	Mg-A1 (65/35) alloy powder 75

**General.** Photoflash Bomb M122 is used for night photographic missions at altitudes up to 20,000 feet and develops 45 million candlepower seconds during the optimum 0.004 second interval of flash duration. Although the body wall of the bomb is relatively thin, the bomb is especially resistant to detonation by bullets or fragment penetration, except in the event of a direct hit on the burster.

**Description.** The bomb is cylindrical and has an average wall thickness of 0.06 inch. The burster is a phenolic plastic tube 1 $\frac{1}{8}$  inches in diameter and approximately 38 inches long. The arming wire issued with

the bomb is a single branch wire about 34 inches long and 0.064 inch in diameter. The use of a safety Fahnestock clip is optional when the bomb is carried internally in aircraft where rated cruising speed is 300 knots or less. When the bomb is carried on an external bomb rack, or on an internal bomb rack of aircraft whose rated cruising speed is in excess of 300 knots, one clip must be used on the arming wire. Trail-Plate Kit M42A2 may be used to modify the fin assembly. The use of trail angles or a trail plate on the fin assembly is dependent upon such conditions as altitude of release, speed of plane, trail angle, and height of burst. This bomb requires Mechanical Time Fuze M147A1.

Trail Plate Kit M42A2 consists of an 8-inch square trail plate, an 8-inch circular spoiler ring, and four screws for attaching the trail plate to the fin. The spoiler ring, when used, is held in place by the fuze. Thus, the drag plate can be used alone or in conjunction with the spoiler ring to produce the drag necessary to obtain the desired trajectory of the bomb.

### Assembly.

1. Remove the bomb from the packing container and remove the tail support assembly.

2. Connect the trail angles, if these are required, to opposite sides of the fin box, using screws, lockwashers, and nuts issued with the kit. Two outer holes on the sides of the fin box align with holes in the trail angles. The webs of trail angles are attached to outer sides of the fin box, and flanges extend out over the side of the fin box.

3. If a trail plate is required instead of trail angles, fit the trail plate over the fin box so that one ear rests on the outside of each side of the fin box. Align the holes in the trail plate ears with the center hole in each side of the fin box. Using the screws issued with the kit, securely fasten the trail plate to the fin assembly.

4. When the bomb is to be carried internally, the suspension bands must be



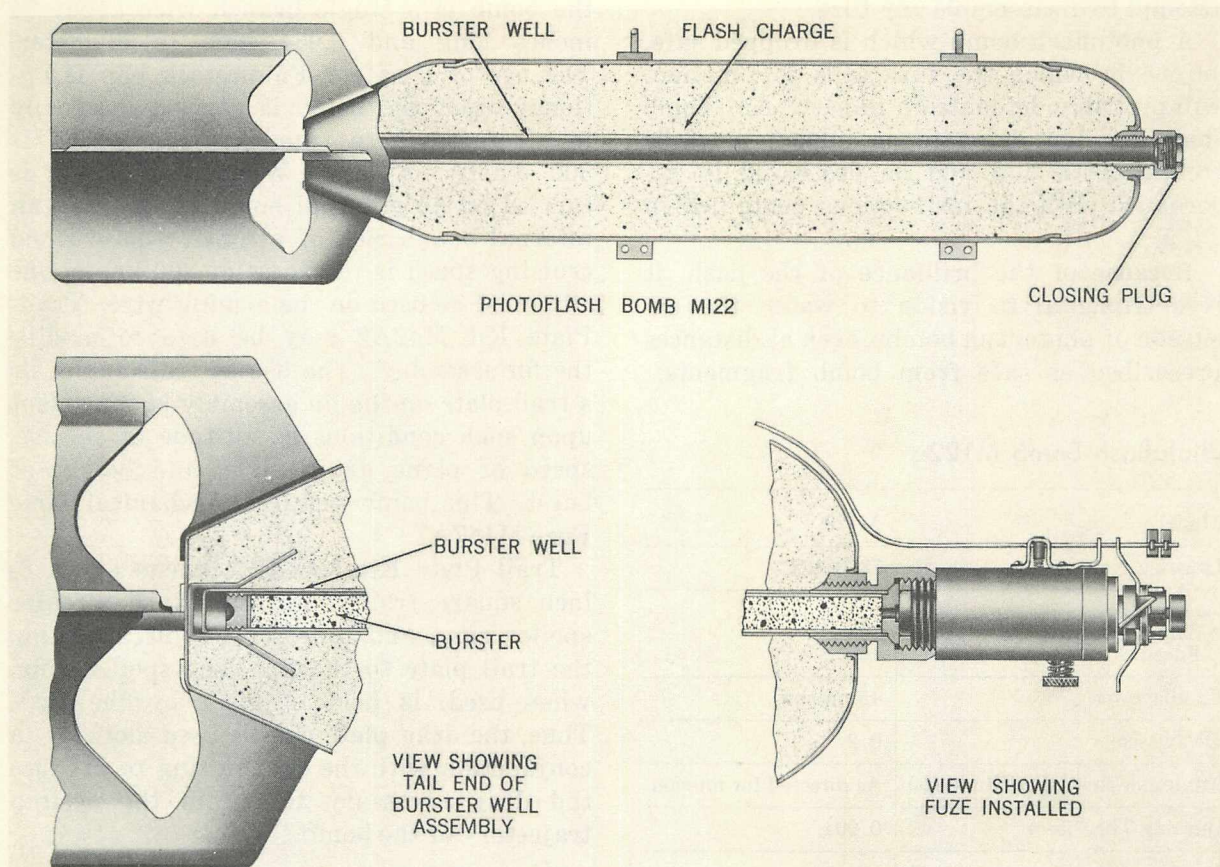


Figure 5.6—Photoflash Bomb M122, Cross Section.

aligned with one of the fin blades. If the bomb is to be carried in external suspension, the suspension bands must be aligned at an angle of  $45^\circ$  to one of the fin blades. If realinement is required, it is necessary only to loosen the nuts and bolts securing the suspension bands, move the bands to the desired position, and then retighten the nuts securely.

5. Remove the closing plug and adapter sleeve from the fuze and burster well. Inspect the cavity to be sure that it is clean and that the threads are not damaged.

6. Remove a burster from its packing container and insert it flanged end outermost in the burster well in the bomb. Replace the threaded adapter sleeve in the cavity so that it bears tightly on the upper surface of the burster.

7. Remove the arming wire from its

water-resistant bag and attach the arming wire loop to the shackle. Straighten the free end of the wire and pass it through, in turn, the front suspension lug, the smaller hole in the spoiler ring (if present), the outer holes in the arming pin bracket and arming pin, and the outer eyelets in the arming wire guide and vane tab. Take up slack in the wire by pulling it forward through the arming pin and vane lock. A safety clip on the arming wire is optional if the bomb is to be carried internally at speeds of less than 300 knots. Bombs carried externally or internally at speeds greater than 300 knots always require a safety Fahnestock clip on the arming wire. Cut off wire 2 to 3 inches in front of the vane tab or the safety Fahnestock clip. Be sure there are no kinks or burrs in the wire.

8. Check the fuze setting.



9. Remove the striker stop, safety cotter pin, and seal wire. Check again for clearance between the striker and the safety block. If the striker should snap down tight against the safety block or if the safety block should fall out, tape the safety block in place, remove the fuze from the bomb, and set it aside for disposition as unserviceable.

**Disassembly.**

1. If the bomb is not dropped, replace the cotter pin in the fuze arming pin, replace the striker stop between the striker and safety block, pass the seal wire through the eyelets in the vane tab and arming wire guide, and fasten the ends of the wire together.

2. Remove the arming wire and unscrew the fuze. Return the fuze to its original condition and packing, and seal the can with adhesive tape. If a spoiler ring is assembled to the bomb, return it to its packing container.

3. Unscrew the adapter sleeve and remove the burster. Return the burster to its original packings.

4. Replace the adapter sleeve and closing plug in the bomb.

5. After defuzing, remove the trail angles or trail plates, if present, from the fin assembly. Return the bomb and trail kits to their original condition and packing.

**Safety Precautions.** Because of the brilliance of the flash, it is detrimental to vision to watch the explosion of photoflash bombs, even at distances prescribed as safe from bomb fragments.

Store Pyrotechnic Bombs M122, bursters, and fuzes in well-ventilated places, out of the direct rays of the sun, and protected against extreme temperatures, as directed in OP 5. Because of the violence of the explosion of this bomb, however, it is recommended that it be stored separately in high-explosive magazines in which no other type of ammunition or explosive is stored.



## Chapter 6

### PHOTOFLASH BOMB FUZES

#### Introduction

Fuzes used in photoflash bombs closely resemble, or are identical to, those used in aircraft bombs.

A typical mechanical time nose bomb fuze is described in this chapter and illustrated in figure 6.1. Following this description are references to specific model fuzes of this type. The fuzes falling into this category are vane and pin arming, and mechanical time or impact firing. The rate of vane arming for this type is directly proportional to the angular velocity of the arming vane.

This type of fuze initiates the main charge or special filler of the bomb, or opens a cluster, a certain number of seconds after release from an aircraft by means of a mechanical clockwork. The fuze operates in a manner similar to an ordinary alarm clock. After a preset length of time has elapsed, the fuze functions to initiate the explosive train. The impact feature is for assurance rather than deliberate selection. This feature operates only when the time setting exceeds the time of flight, or when a malfunction occurs in the timing mechanism. This type of fuze is detonator safe and there are no restrictions on its use in any naval activity.

**Description.** The fuze is marked with the words "NOSE, BOMB, FUZE" and the model designation. This marking is usually stamped, although it may be stenciled, on the fuze body. Marks indicating time settings ranging from 5 to 92 seconds are stamped in the head. Every third second from 6 to 90 is numbered, and the graduations are divided into one-half second increments. The words "TIGHTEN AFTER SETTING" arrowed to the thumbscrew, and the loader's lot number, loader's identifica-

tion symbol, and date loaded (month and year) are stamped in the body. The end of the arming pin is stamped with an arrow and the word "UP."

The head contains the arming-vane and firing-pin mechanisms and the body contains the clockwork mechanism and the explosive train. The head and body are held together by a spring steel ring which is compressed by three screws in the body. Variation of screw pressure made at the factory provides adjustment of the torque required to change the time setting on the fuze. A thumb-screw is provided to lock the head in position after the setting has been made. The arming pin and arming-wire guide are assembled on the side of the body opposite the thumb-screw. A slider cover, fastened to the body near its lower end, closes one end of the detonator slider assembly. A large screw, 90° around the body from the slider cover, holds the detonator-slider detent and detent spring in place. This screw is staked to the body.

An index mark for time setting is stamped in the body just below the head. The time graduations are stamped around the base of the head, and two stop pins are set in the time scale so as to butt against the arming-wire guide at maximum and minimum time settings. The arming hub with vane assembly, the arming sleeve, and the firing pin with striker project through the forward end of the head. A C-shaped safety block is held in place between the striker and vane nut by the arming sleeve. The safety block has a safety-block collar which bears on two vane-nut pins in the vane nut. The bearing of the collar on the pins insures that the safety block will spin with the arming vane and develop sufficient centrifugal



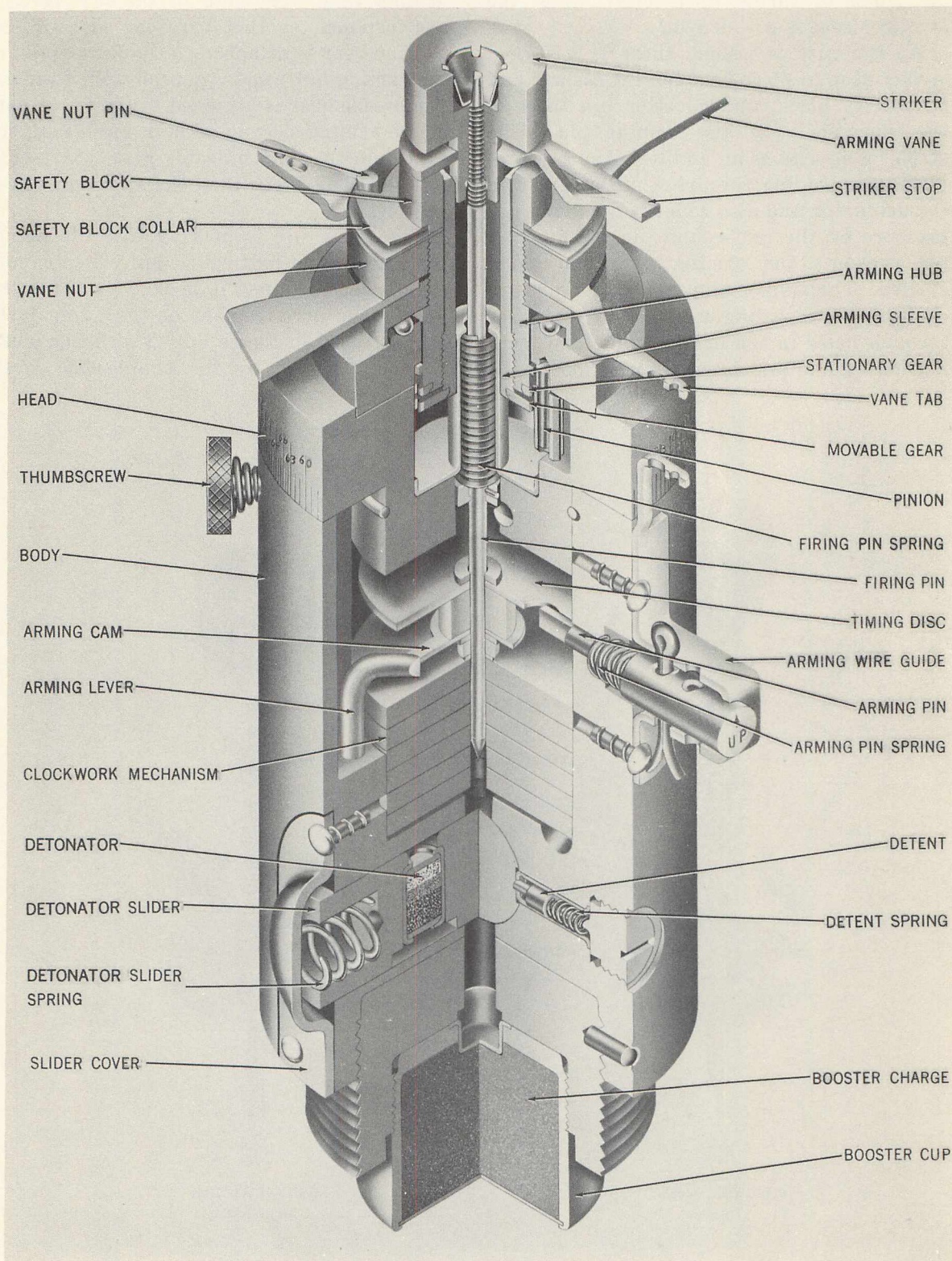


Figure 6.1—Typical Nose Fuze (Mechanical Time, Vane Arming, Impact and Time Firing) Unarmed, Sectional View.



gal force to throw itself clear when the arming sleeve is withdrawn.

As the fuze is issued, there is a forked striker stop in place between the striker and the safety block, and a cotter pin through the inner hole in the arming pin. The striker stop acts as an additional safety provision for holding the firing pin away from the detonator and also relieves the firing pin pressure on the half-round pin. The cotter pin prevents the arming pin from being ejected. The striker stop and cotter pin are connected by a sealing wire which also passes through holes in the arming vane and arming-wire guide and prevents rotation of the

arming vane. The ends of the sealing wire are fastened together by a car seal. A stationary gear is attached to the lower part of the arming hub and is in mesh with a pinion. A movable gear is attached to the lower part of the arming sleeve and is in mesh with the same pinion. The movable gear (34 teeth) has one more tooth than the stationary gear (33 teeth).

The firing pin is held against the firing-pin spring by a half-round pin which cannot turn because its peg is hooked by the firing lever. The arrangement of the firing lever is illustrated in figure 6.2. The firing lever, in turn, is held by the timing-disc lever,

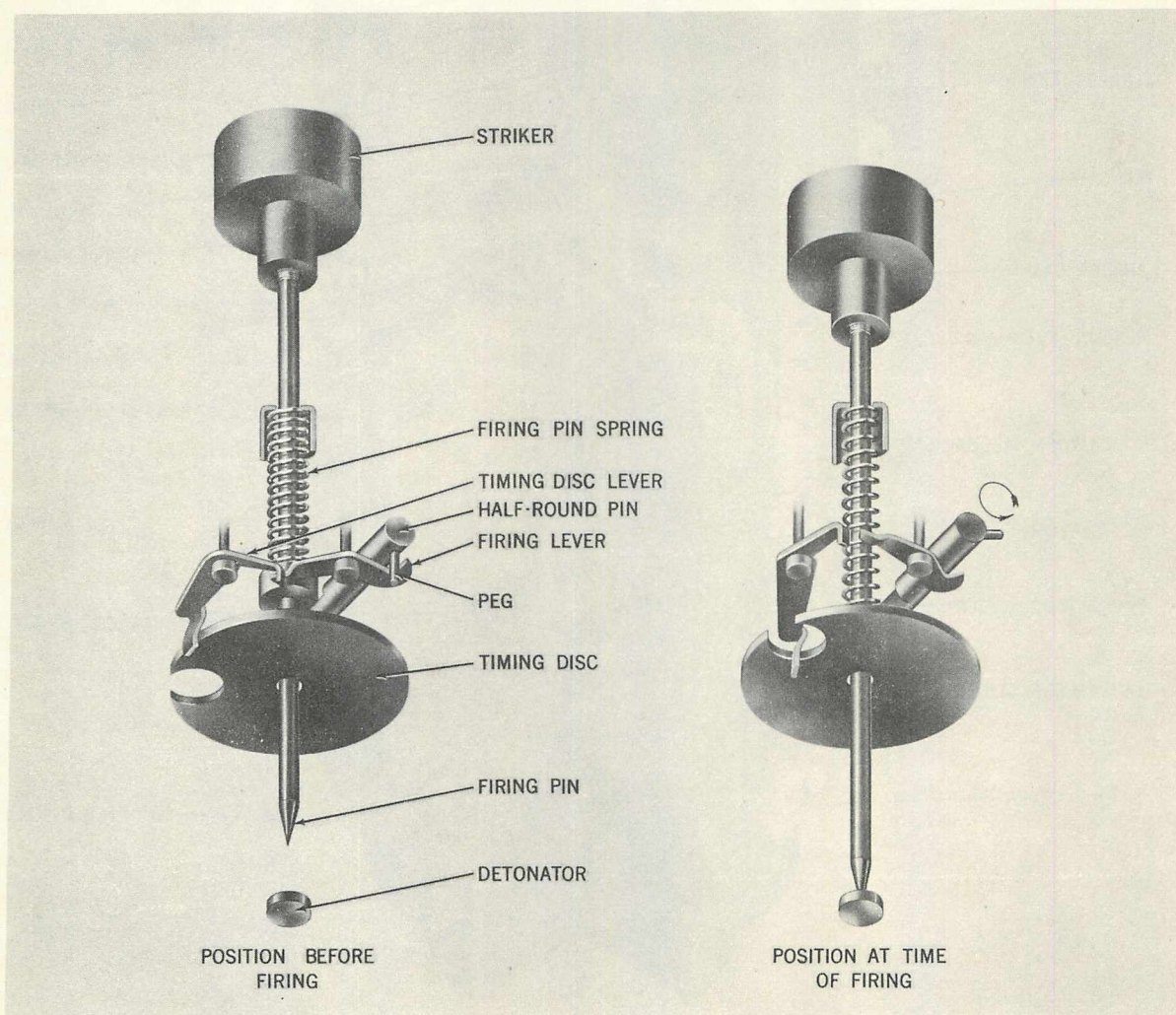


Figure 6.2—Method of Arming Mechanical Time Fuze.



which rides on the edge of the timing disc. The timing disc has a notch in which one end of the arming pin rests, and into which the timing disc lever drops after rotation of the timing disc. A spring-wound clockwork time mechanism acts to turn the timing disc.

Below the timing disc and attached to the main shaft of the clockwork mechanism is an arming cam which restrains the arming lever. This arming lever has a half-round section at its lower end which restrains the spring-loaded detonator slider. The detonator slider, by the action of the detonator-slider spring, is constantly acting to turn the arming lever out of its path and to move to the armed position. The detonator slider has a notch in its side to receive the spring-loaded detent.

#### Operation.

**ARMING.** This fuze is set for the time desired by loosening the thumbscrew, turning the head to the desired time graduation, and tightening the thumbscrew. This locates the timing-disc lever a distance from the notch in the timing disc which will give the time desired.

When the bomb is dropped from the aircraft, the arming wire is withdrawn from the arming pin and arming vane. The arming wire remains in the aircraft. The fuze is now free to arm. Two arming actions take place simultaneously. The actions, however, are independent and one may occur without the other in abnormal circumstances. They serve to remove the two safety mechanisms inherent in the fuze, namely, the safety block which holds the firing pin away from the detonator and the arming pin which indirectly prevents the detonator from moving into a position below the firing pin.

After the arming wire is withdrawn from the arming pin, the arming-pin spring ejects the arming pin. As soon as the arming pin is removed from the notch in the timing disc, the timing disc and arming cam are free to revolve. They are driven by the clockwork mechanism which is wound at the factory and which needs no further atten-

tion. The timing disc revolves until its notch releases the timing-disc lever. This action is described in the subparagraph "Firing." As the arming cam revolves, it releases the arming stem. The pressure of the spring-loaded detonator slider against the half-round section of the arming stem causes the arming stem to turn. As the arming stem turns, it clears the path of the detonator slider and thus allows the detonator slider to move into the armed position. In the armed position, the detonator is located directly below the firing pin. The detonator slider is locked in place by a spring-loaded detent. The detonator moves into position below the firing pin 4.5 seconds after the arming pin is ejected.

After the arming wire is withdrawn from the arming vane, the arming vane is free to rotate. The air stream rotates the arming vane and the parts adjacent to it, namely the safety block, vane nut, upper ball race, arming hub, arming sleeve, stationary gear, and movable gear. The stationary gear and movable gear are connected to the arming hub and arming sleeve respectively. The stationary gear and movable gear are both in mesh with the pinion. Since the movable gear has one more tooth than the stationary gear, it lags one tooth for every revolution of the stationary gear and gradually unscrews downward. After approximately 260 vane revolutions, the arming sleeve has unthreaded far enough to be withdrawn from the safety block, which is thrown clear by centrifugal force.

**FIRING.** After the fuze has become armed, only the half-round pin prevents the firing-pin spring from driving the firing pin into the detonator. The pressure of the firing pin on the edge of the half-round pin tends to rotate the half-round pin, but rotation is prevented by the firing lever that bears on the peg in the half-round pin. The mechanism performs to release the firing pin as follows.

The timing disc is revolved at a uniform speed by the clockwork mechanism until the notch is opposite the timing-disc lever; the timing-disc lever rotates into the notch in the timing disc and releases the firing lever;



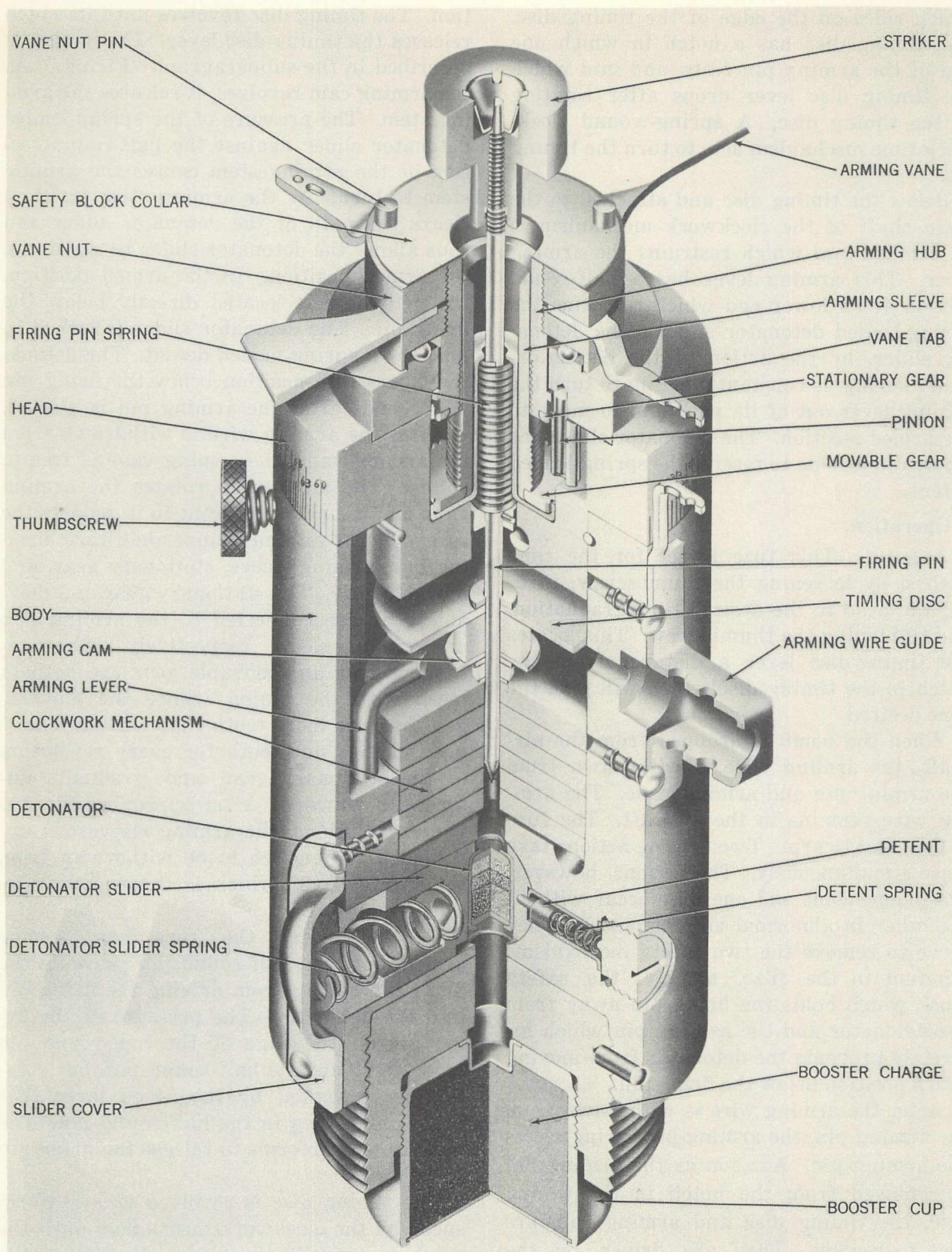


Figure 6.3—Typical Nose Fuze (Mechanical Time, Vane Arming, Impact and Time Firing) Armed, Sectional View.



the firing lever rotates and releases the peg in the half-round pin. The half-round pin is rotated by the firing pin as the firing pin is driven into the detonator by the firing-pin spring. The stabbing action of the firing pin initiates the detonator. The detonator serves the purpose of initiating the explosive train.

#### Installation.

1. Remove the fuze from its packing and inspect it to insure that the safety block is in place, the arming pin is in its proper position, the fuze threads are clean, and that there is no indication of serious corrosion or other evidence of unserviceability. Special attention should be given to examination for evidence of corrosion. A small amount of external corrosion may indicate sufficient internal corrosion to freeze the time mechanism or detonator slider and cause a dud or, conversely, it may indicate primer corrosion or weakening of light parts which would render the fuze unsafe to handle. Holding the safety block in place, remove the striker stop and examine for clearance between striker and safety block. If a clearance does not exist, it is an indication that the half-round pin is not supporting the firing pin and the fuze may fire as soon as the safety block is ejected. In this event the safety block should be taped in place and the fuze destroyed as soon as possible. Shake the fuze gently to see if the safety block falls out. If it does, replace it, secure it with tape, and dispose of the fuze as soon as possible. Replace the striker stop if these tests have indicated that the fuze is serviceable.

2. Loosen the thumbscrew and turn the head until the desired time is indicated by the index mark on the body. Tighten the thumbscrew to lock the setting. It should be noted that there is a time lag of 0.2 second between the release of the bomb and the starting of the time mechanism. This is due to the fact that the bomb falls for 0.2 second after release before the arming wire is withdrawn and the arming pin ejected. Due consideration should be given to the time lag in selecting the time setting. Thus, if it is desired that the fuze function 21.5

seconds after release, the fuze should be set for 21.3 seconds.

3. Remove the nose plug from the bomb and inspect the fuze seat to be sure that it is clean and that the threads are not damaged. The fuze may be installed in the bomb before installation of the bomb in the rack, but it is preferred that all fuzing be done after the item is installed in the rack.

4. If the threaded hole in the bomb is too large, install the appropriate adapter booster.

5. Screw the fuze into the cavity, handtight.

6. Attach the arming wire loop to the shackle. Straighten the free end of the wire and pass it through, in turn, the front suspension lug, the smaller hole in the spoiler ring (if present), the outer holes in the arming-pin bracket and arming pin, and the outer holes in the arming-wire guide and arming vane. Take up slack in the wire by pulling it forward through the arming pin and arming vane. The use of a Fahnestock clip on the arming wires of mechanical time fuzes is mandatory where munitions, so fuzed, are by tactical necessity carried on external bomb racks or carried on internal racks of aircraft whose rated cruising speed is in excess of 300 knots. Use is optional when the munitions are carried internally in slower rated aircraft. Cut off the arming wire 2 or 3 inches in front of the arming vane or safety Fahnestock clip. Be sure that there are no kinks or burrs in the arming wire.

7. Check the time setting on the fuze.

8. Remove the striker stop, safety cotter pin, and seal wire. Check again for clearance between the striker and the safety block as described in step 1. If the safety block should fall out, replace it, secure it with tape, remove the fuze from the bomb, and set it aside for destruction.

**Removal.** If the bomb is not dropped, replace the cotter pin in the fuze arming pin, replace the striker stop between the striker and safety block, pass the seal wire through the holes in the arming vane and arming wire guide, and fasten the ends of the wire



together. Then remove the arming wire and unscrew the fuze. Replace the closing plug in the bomb. Return the fuze to its original container and seal with adhesive tape.

**Packaging.** The fuze is packed in a hermetically sealed metal can similar to an elongated coffee can. The can is painted black and marked with the words "FUZE, BOMB, NOSE, MT" and the model designation, lot number, loader's symbol, and date loaded. Fifteen individual fuze containers are packed in a wood box which is clearly marked with fuze nomenclature, minimum safe air travel time (MINSAT), ammunition lot number, date of loading, number of arming delays, and Army identification code number, as well as the consignor and consignee.

#### **Safety.**

**SAFETY DEVICES.** The fuze is prevented from firing by two basic safety devices, the safety block and the out-of-line detonator. The safety block prevents the firing pin from moving downward toward the detonator during all but severe impacts. The detonator is prevented from moving into position below the firing pin by the arming pin. If the detonator, which contains the most sensitive explosive in the fuze, should explode, the detonating impulse will be dissipated in the fuze body and will not be passed on to the next element in the explosive train. If the fuze is dropped unarmed, it should not function.

**ARMED AND PARTIALLY ARMED FUZES.** If there is any reason to believe that either of the safety devices has inadvertently been rendered ineffective, the fuze must be considered partially armed and disposed of as soon as possible. If, upon removing the striker stop, the striker clamps down against the safety blocks, the fuze must be considered partially armed.

Fuzes which have the arming sleeve protruding less than  $\frac{1}{8}$  inch above the surface of the vane nut should be considered partially armed.

Fuzes which have the arming pin missing must be considered partially armed. Also,

if the arming pin is allowed to move outward  $\frac{1}{10}$  inch, the timing mechanism will start. If the safety cotter pin is found located in the outer holes of the arming-wire guide, the cotter pin should be examined to see that it is through the outer hole in the arming pin as well because, when the inner hole of the arming pin is opposite the outer holes in the arming-wire guide, the timing mechanism has been released.

Fuzes which have the seal wire missing should be carefully checked for partial arming. If the striker stop is missing or out of place, the striker should be tested to see if a spring force holds it against the safety block. If the striker clamps tight against the safety block, the fuze is partially armed.

If there is reason to believe that both the safety devices have been rendered ineffective, the fuze must be considered armed. Fuzes which have the arming pin and safety block missing are to be considered armed and should be handled and disposed of by personnel trained in explosive ordnance disposal.

#### **Special Instructions.**

**FUZES EXPOSED TO WEATHER.** It is recommended that fuzes which have been installed and exposed to weather for approximately three weeks be replaced with new fuzes. However, depending upon the weather conditions under which the aircraft are operating, it may be necessary to replace the fuzes after a shorter period of exposure.

**REPORTS OF MALFUNCTIONING.** Malfunctioning and troubles encountered with this fuze should be reported to the Bureau of Ordnance. The report should contain the lot number of the fuze and other ammunition components such as the flare or bomb in which used, in addition to the detailed description of the conditions, previous history, and other pertinent information relating to the ordnance material and the malfunctioning or trouble encountered.

**DISASSEMBLY.** No attempt should be made to disassemble these fuzes. Fuzes which have become damaged, corroded, or otherwise unserviceable should be disposed



of in accordance with the latest BuOrd directives.

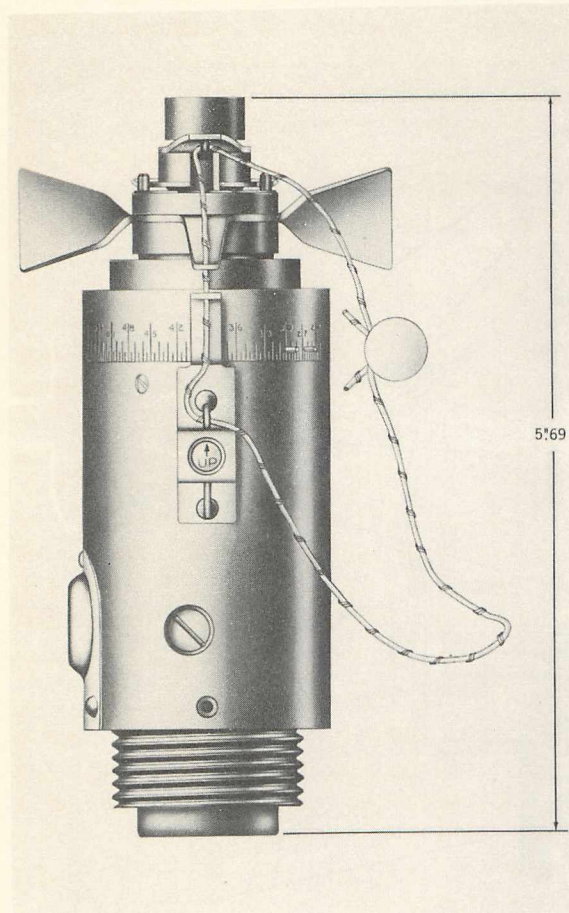


Figure 6.4—Mechanical Time Fuze AN-M146A1,  
External View.

**General.** Fuze AN-M146A1 is identical to the mechanical time nose fuze described in this chapter. Fuze AN-M146A1 evolved from Fuze AN-M146 through a series of experimental models. Because of an emergency, some of the experimental models were produced and have been stocked.

Fuze AN-M146E1 is Fuze AN-M146 with the booster charge increased from 70 grains of black powder to 110 grains of black powder.

Fuze AN-M146E2 is Fuze AN-M146E1 with a clockwork mechanism that has been reworked for low temperature operation.

### Mechanical Time Fuze AN-M146A1

Model	AN-M146A1
Drawing No.	73-8-328
Overall Length (in.)	5.69
Body Diameter (in.)	1.93
Weight (lb)	1.6
Protrusion from Bomb (in.)	4.9
Vane Span (in.)	3
Number of Vanes	2
Time Setting Range (sec)	5-92
Arming Type Revolution to Arm Air Travel to Arm (ft) Time to Arm (sec)	Delayed and time 260-350 1000-1300 4.5
Booster Charge Type Weight (grains)	Black powder 110
Detonator Model Type	M19A2 Primer mixture, lead azide, tetryl
Shipping Container Number per Container Type Weight (lb)	15 Wood box 48

Fuze AN-M146E3, which was standardized to become Fuze AN-M146A1, is Fuze AN-M146E2 with an added protective finish.

Previous models similar to Fuze M146A1 are Fuze M111A2 and Fuze M155A1. Fuze M111A2 and Fuze M155A1 are similar to Fuze M146A1, but do not have the sliding detonator feature or the mechanisms which control it. The overall length of Fuze M111A2 is 4.48 inches; the M155A1 is 4.47 inches.

In Fuze M155A1, a pin is substituted for the pinion and there is no stationary gear. The pin prevents the movable gear from turning, and the number of vane revolutions required to arm the fuze is reduced considerably. Fuze M155A1 arms within a range of 6 to 9 vane revolutions. Fuze M111A2 and Fuze M155A1 are not detonator safe. They are not to be used from aircraft carriers, and may possibly function when dropped unarmed.



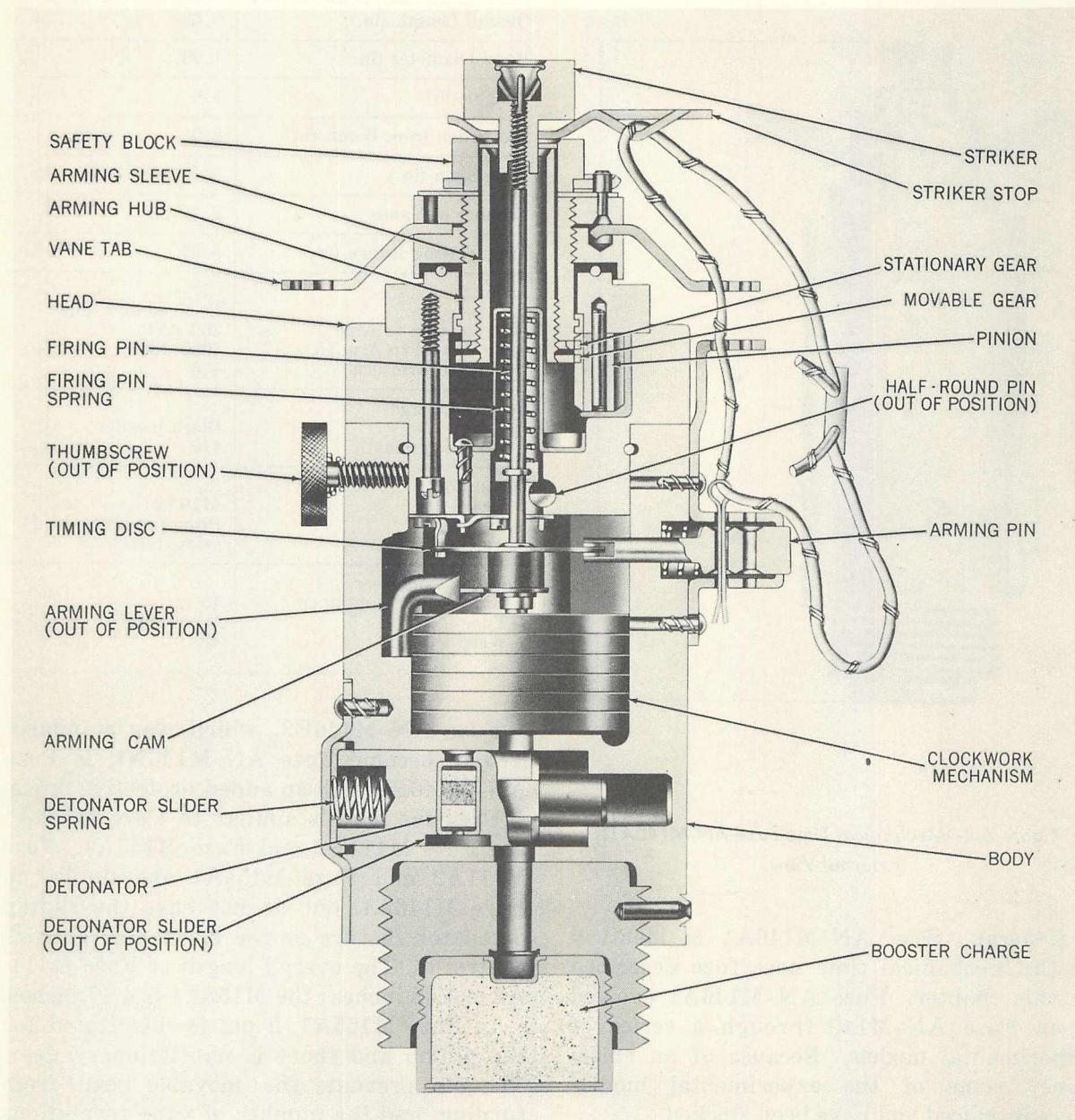


Figure 6.5—Mechanical Time Fuze AN-M146M1, Cross Section.



**General.** Fuzes AN-M147 and AN-M147A1 are similar to the mechanical time nose fuze described in this chapter. They differ in that they have booster leads of high explosive instead of boosters filled with black

powder. The M147A1 differs from the M147 in that the M147A1 has a protective finish and a reworked clock movement that makes it more suitable for low temperature operation. These fuzes are detonator safe.

**Mechanical Time Fuzes AN-M147 and AN-M147A1**

Model	AN-M147	AN-M147A1
Drawing No.	73-8-330	73-8-330
Overall Length (in.)	5.72	5.72
Body Diameter (in.)	1.93	1.93
Weight (lb)	1.6	1.6
Protrusion from Bomb (in.)	4.9	4.9
Vane Span (in.)	3	3
Number of Vanes	2	2
Time Setting Range (sec)	5-92	5-92
Arming Type Revolutions to Arm Air Travel to Arm (ft) Time to Arm (sec)	Delayed and Time 260-350 1000-1300 4.5	Delayed and Time 260-350 1000-1300 4.5
Booster Lead Type Weight (grains)	Tetryl 7.6	Tetryl 7.6
Detonator Model Type	M19A2 Primer mixture, lead azide, tetryl	M19A2 Primer mixture, lead azide, tetryl
Shipping Container Number per Container Type Weight (lb)	15 Wood 48	15 Wood 48



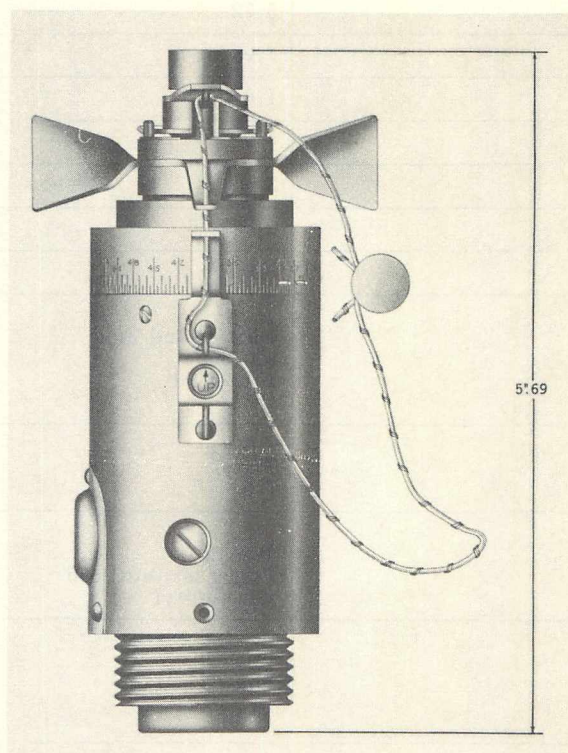


Figure 6.6—Mechanical Time Fuze AN-M147,  
External View.



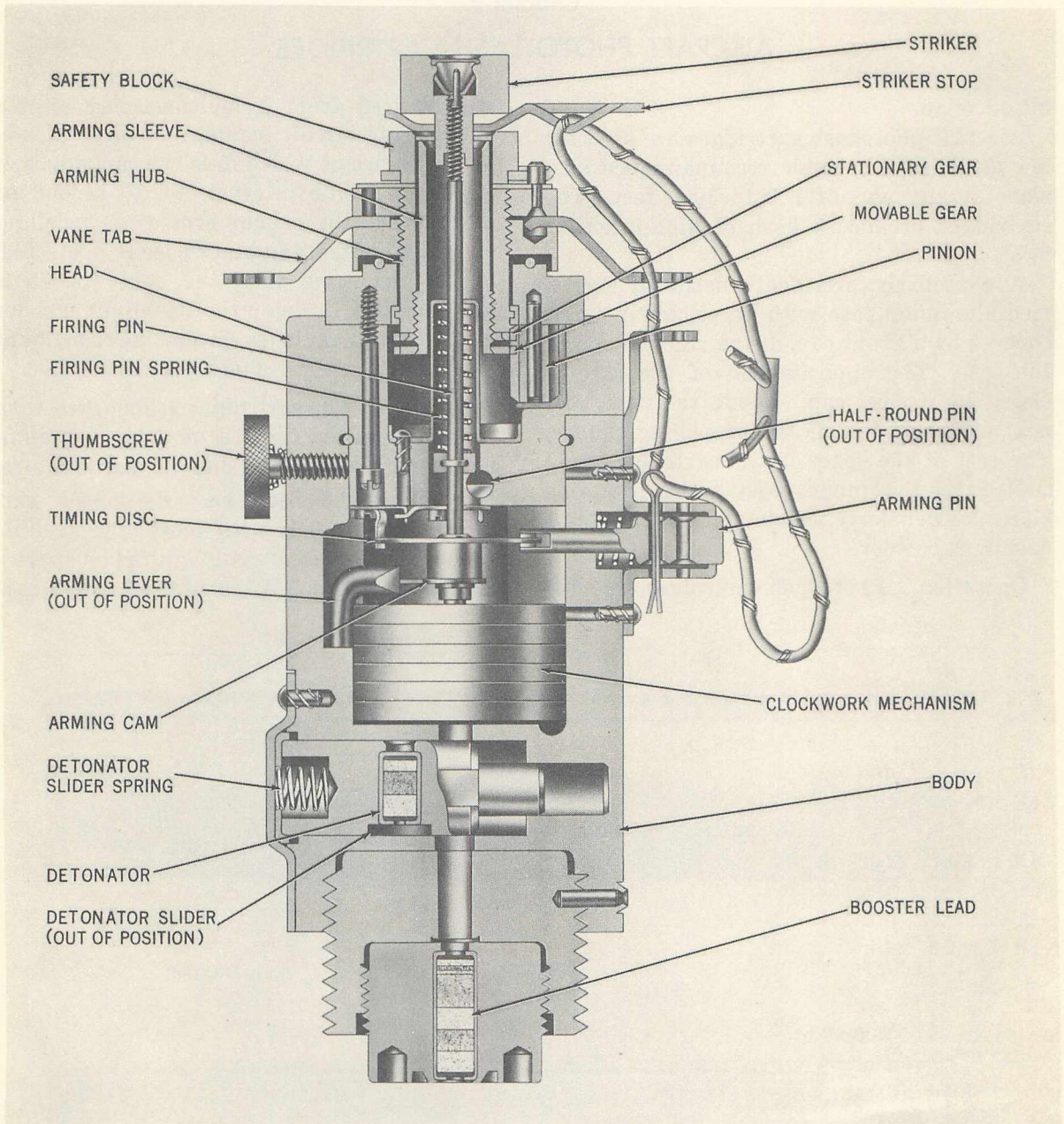


Figure 6.7—Mechanical Time Fuze AN-M147, Cross Section.



## Chapter 7

### AIRCRAFT PHOTOFLASH CARTRIDGES

#### Introduction

Aircraft photoflash cartridges are used for low aerial photographic reconnaissance missions at altitudes of 100 to 5000 feet. The cartridges produce a flash of high-intensity light.

A photoflash cartridge consists of a rimmed aluminum case with an electric primer, covered by a shunt cap, at the rimmed end of the case. The opposite end of the case is closed by a steel cap. Inside the case, and next to the primer, is the propelling charge. The rest of the space in the cartridge is occupied by the inner case, which contains black powder delay pellets and the charge of flashlight powder.

**Operation.** Photoflash cartridges are elec-

trically fired from a multibarreled ejector whose firing circuit includes an intervalometer in the circuit which fires the cartridges at the desired time intervals of  $\frac{1}{2}$  second or more. When the primer fires, the propelling charge is ignited, the inner case is projected, and at the same time the delay pellet is ignited. After a delay the flashlight powder is ignited and explodes, producing a brilliant flash of light for a short period of time.

**Marking.** The cartridges are marked with the nomenclature, length of delay, lot number, manufacturer, and date of manufacture.

**Handling and Stowage.** Photoflash cartridges are loaded with loose pyrotechnic composition which is easily ignited by sparks, shock, or friction. When ignited, these car-

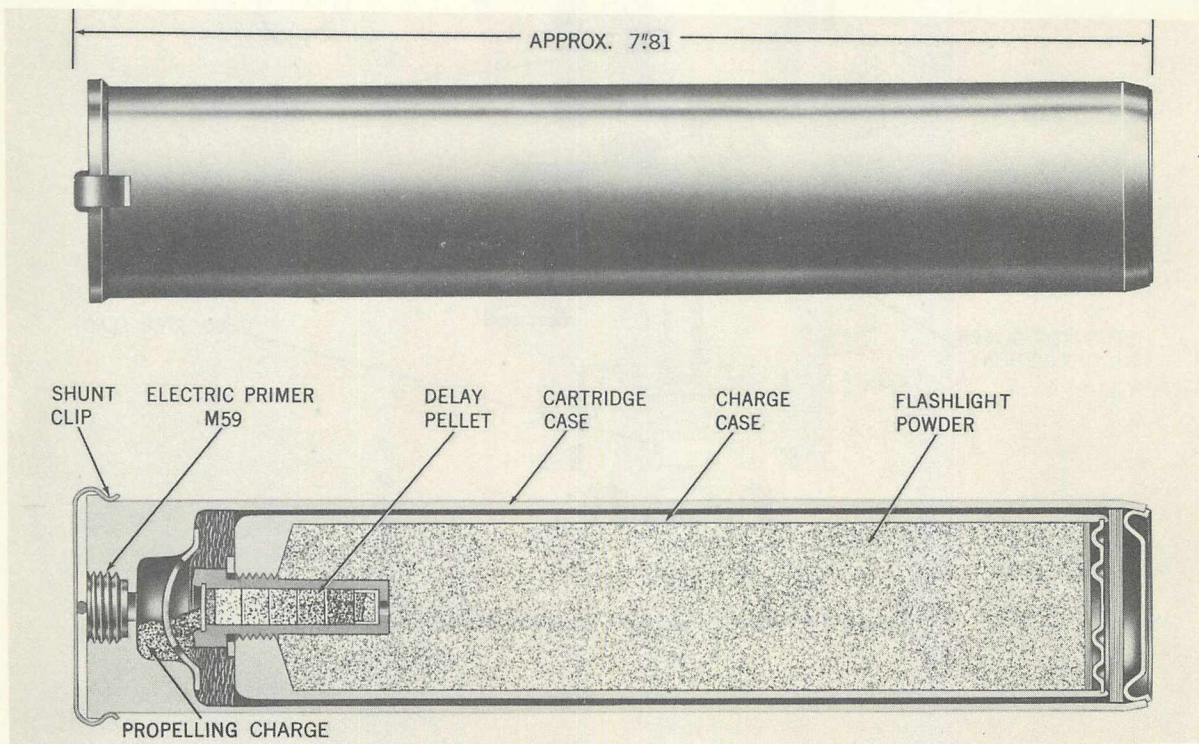


Figure 7.1—Photoflash Cartridge M112, External View and Cross Section.



tridges explode with extreme violence and extreme heat. They must be handled with the same care as black powder, and with even greater care than ordinary pyrotechnic materials.

The cartridge cases should not be hammered or cut. No work should be done on them, except unpacking or loading in the ejector.

These cartridges should be kept in stand-

ard pyrotechnic-type stowage ashore. Afloat, the cartridges may be stowed in regular pyrotechnic magazines if no separate locker is available. They must be secured against any movement.

**Disposal.** Unserviceable cartridges are to be disposed of in accordance with current instructions.

**General Safety Precautions.** Do not re-

### Photoflash Cartridge M112

Model	M112 (T12E1)	M112 (T12E2)	M112 (T12E4)
Drawing No.	78-0-114	78-0-114	78-0-114
Weight (lb)			
Maximum Release Altitude (ft)	5000	5000	5000
Delay (sec)	1	2	4
Candlepower	50 million	50 million	50 million
Delay Element	Black powder pellet	Black powder pellet	Black powder pellet
Illuminant Type Weight (oz)	Photoflash powder 7	Photoflash powder 7	Photoflash powder 7
Propellant Type Weight (grains)	Black powder 35	Black powder 35	Black powder 35
Case	Aluminum	Aluminum	Aluminum
Shipping Container Number of Rounds Type Weight (lb)	40 Wood box 75	40 Wood box 75	40 Wood box 75

move the shunt cap from the cartridge until just prior to loading the cartridge in the ejector.

Do not attempt to disassemble or alter a cartridge in any way.

**General.** The three types of Photoflash Cartridge M112 differ from each other only

in the amount of delay, as shown in the table. This delay time is plainly marked on each cartridge.

These cartridges are provided for use in connection with aerial photography at low altitudes, 100 to 5000 feet, and high speeds, up to Mach 0.95, during reconnaissance mis-

### Photoflash Cartridge M123

Model	M123	M123	M123
Drawing No.	78-0-134	78-0-134	78-0-134
Weight (lb)	4.3	4.3	4.3
Maximum Release Altitude (ft)	7000	7000	7000
Delay (sec)	2	4	6

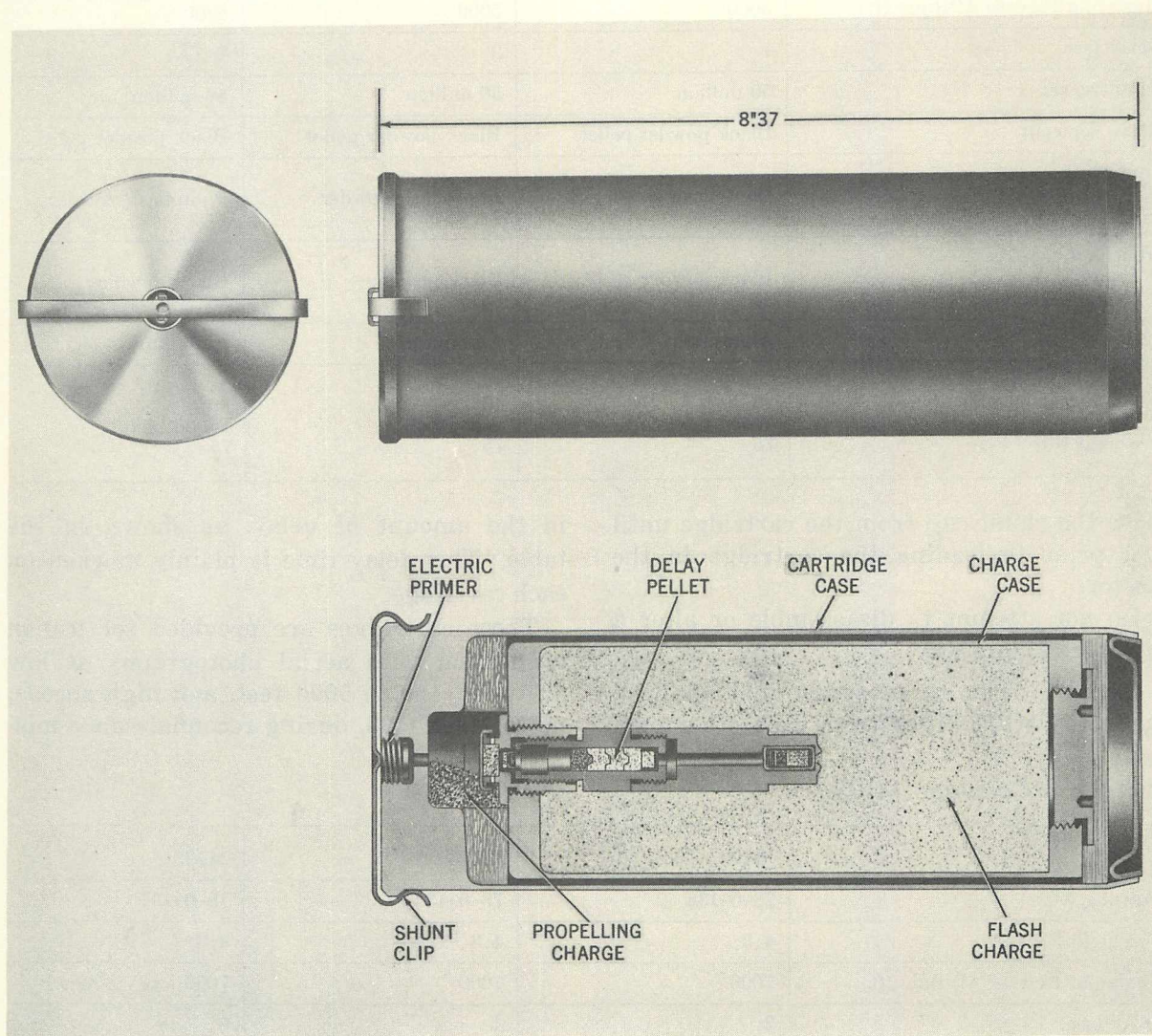


Candlepower	5,600,000	5,600,000	5,600,000
Illuminant Type Weight (lb)	Photoflash powder 1.75	Photoflash powder 1.75	Photoflash powder 1.75
Propellant Type Weight (lb)	Black powder 0.006	Black powder 0.006	Black powder 0.006
Case			
Primer	M59	M59	M59
Shipping Container Number of Rounds Type Weight (lb)	6 Wood 59	6 Wood 59	6 Wood 59

sions. They are fired from Ejector, Type A6.

**General.** The three types of Photoflash Cartridge M123 differ from each other only

in the amount of delay, as shown in the table. This delay time is clearly marked on each cartridge.





## Chapter 8

### MISCELLANEOUS EXPLOSIVE ITEMS

#### Introduction

A number of items of military use that do not fit into the category of pyrotechnics are included in this publication because they are so unique in themselves, or there is such a small number of related items, that treatment in a separate volume is not advisable.

#### General

Aircraft Engine Starter Cartridge, Type II, is used for emergency ignition of J48

#### Aircraft Engine Starter Cartridge, Type II

Type	II
Drawing No.	P & W 208314
Filler Type Weight (oz)	Magnesium 0.4
Case	Cardboard
Shipping Container Number of Rounds Type	200 Wood

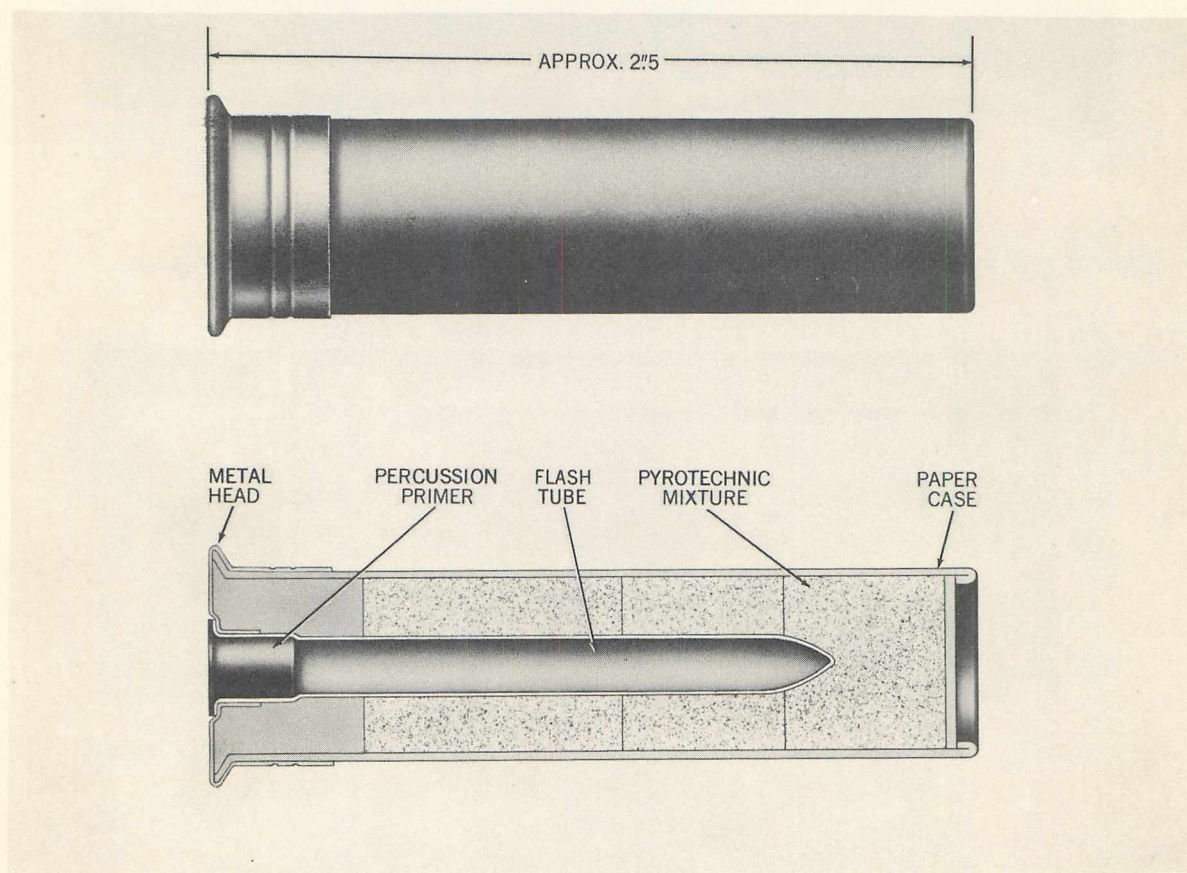


Figure 8.1—Aircraft Engine Starter Cartridge, Type II, External View and Cross Section.



Turbo Jet Engines. "Type II" is the designation given those cartridges used on engines that have displacements ranging from 1535 cubic inches to 2600 cubic inches. This cartridge is a nonelectric igniter that provides a shot of flame when its magnesium filler is ignited by a percussion primer.

The cartridge resembles a shotgun car-

tridge and is yellow in color. Two cartridges are used in an engine. They may be fired individually or together.

**Stowage and Disposal.** This cartridge should be stowed with small arms ammunition. Unserviceable cartridges are to be disposed of as indicated in current directives.

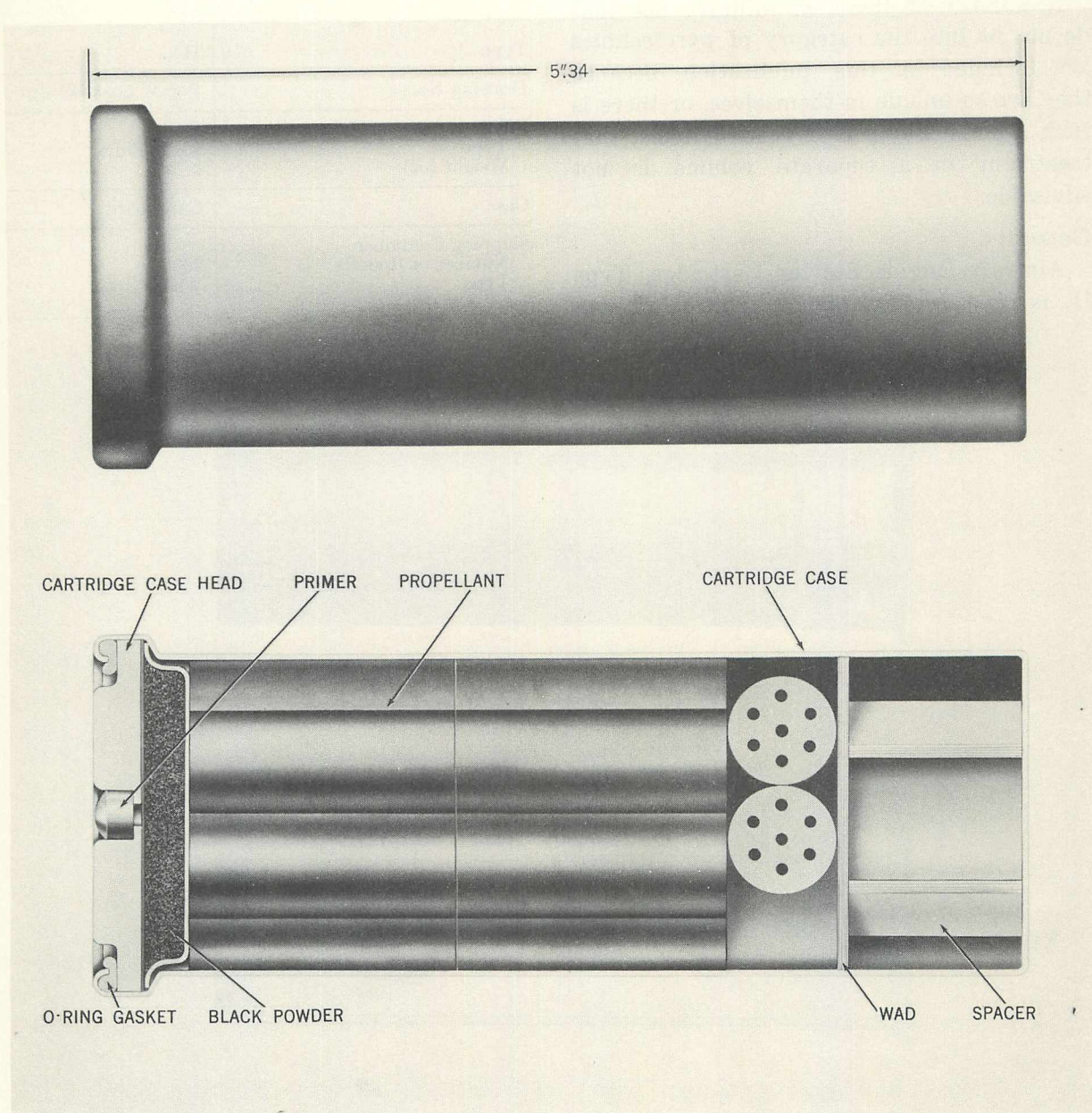


Figure 8.2—Personnel Ejection Catapult Cartridge Mk 1 Mod 0, External View and Cross Section.



**Packaging.** Normally ten cartridges are packed to a rectangular can. Twenty cans are shipped in a wood box.

### Personnel Ejection Catapult Cartridge Mk 1 Mod 0

Mk	1
Mod	0
Drawing No.	583515
Length (in.)	5.34
Diameter (in.)	1.85
Ignition Charge Type Weight (grains)	Black powder 100
Propellant Type Weight (grams)	Smokeless powder 133
Case	Aluminum
Shipping Container Number per Metal Can Number of Cans per Metal Container Weight (lb)	3 4 27

**General.** Personnel Ejection Catapult Cartridge Mk 1 Mod 0 is used with Personnel Catapults NAF 602200-1 and NAF 602223-1. It consists of a hermetically sealed aluminum case containing an ignition charge of black powder and a propelling charge of smokeless powder. This cartridge is percussion fired and was designed to eject the seat with a velocity of 60 feet per second.

**Installation.** Instructions covering the installation of this cartridge in ejection seat catapults are contained in the specific "Handbook of Maintenance Instructions" for each type of aircraft using the NAF 602200-1 or NAF 602223-1 personnel catapults. It is to be emphasized that the firing mechanism of the catapult must be cocked and the catapult safety pin installed before the firing mechanism is screwed down. In the uncocked position, the firing pin will strike the cartridge primer when the firing mechanism is screwed down.

Personnel Ejection Catapult Cartridge

Mk 1 Mod 0 shall not be used in the ejection seat trainer. Breakdown of these cartridges for any purpose is prohibited.

**Handling and Stowage.** Personnel Ejection Catapult Cartridge Mk 1 Mod 0 is to be handled and stowed as small arms ammunition. Ejection seats with cartridges installed should be shielded from direct sun, steam pipes, or other sources of heat after they are removed from the aircraft.

Cartridges are packed three to a hermetically sealed tearstrip metal can. Four such cans are packed in a metal container. Cartridges removed from or stored in open containers have a service life of two years. A storage life of three years has been established on any cartridge lot, after which the cartridges must be installed in planes or the lot must be reaccepted on the basis of tests of representative samples. When a can of three cartridges is opened, each cartridge in the can shall be stenciled as follows:

"Container opened \_\_\_\_ day \_\_\_\_ month \_\_\_\_ year

Service life expires \_\_\_\_ day \_\_\_\_ month \_\_\_\_ year."

The expiration date is two years from the date of opening. Prior to installation in a plane, the type and bureau number of the plane shall be stenciled on the cartridge case. No cartridge shall be removed from one aircraft and used in another.

The cartridge shall be removed from the catapult before the seat or catapult is removed from the aircraft.

**Disposal.** Cartridges are to be disposed of in accordance with current instruction.

**General.** Personnel Ejection Catapult Cartridge Mk 2 Mod 0 is for use with Ejection Seat Trainer, Device 6EQ-2A. It consists of a hermetically sealed aluminum case containing an ignition charge of black powder and a propelling charge of smokeless powder. The cartridge is percussion fired.

**Installation.** Instructions for installation are contained in the instructions for use and operation of the Ejection Seat Trainer, Device 6EQ-2A.



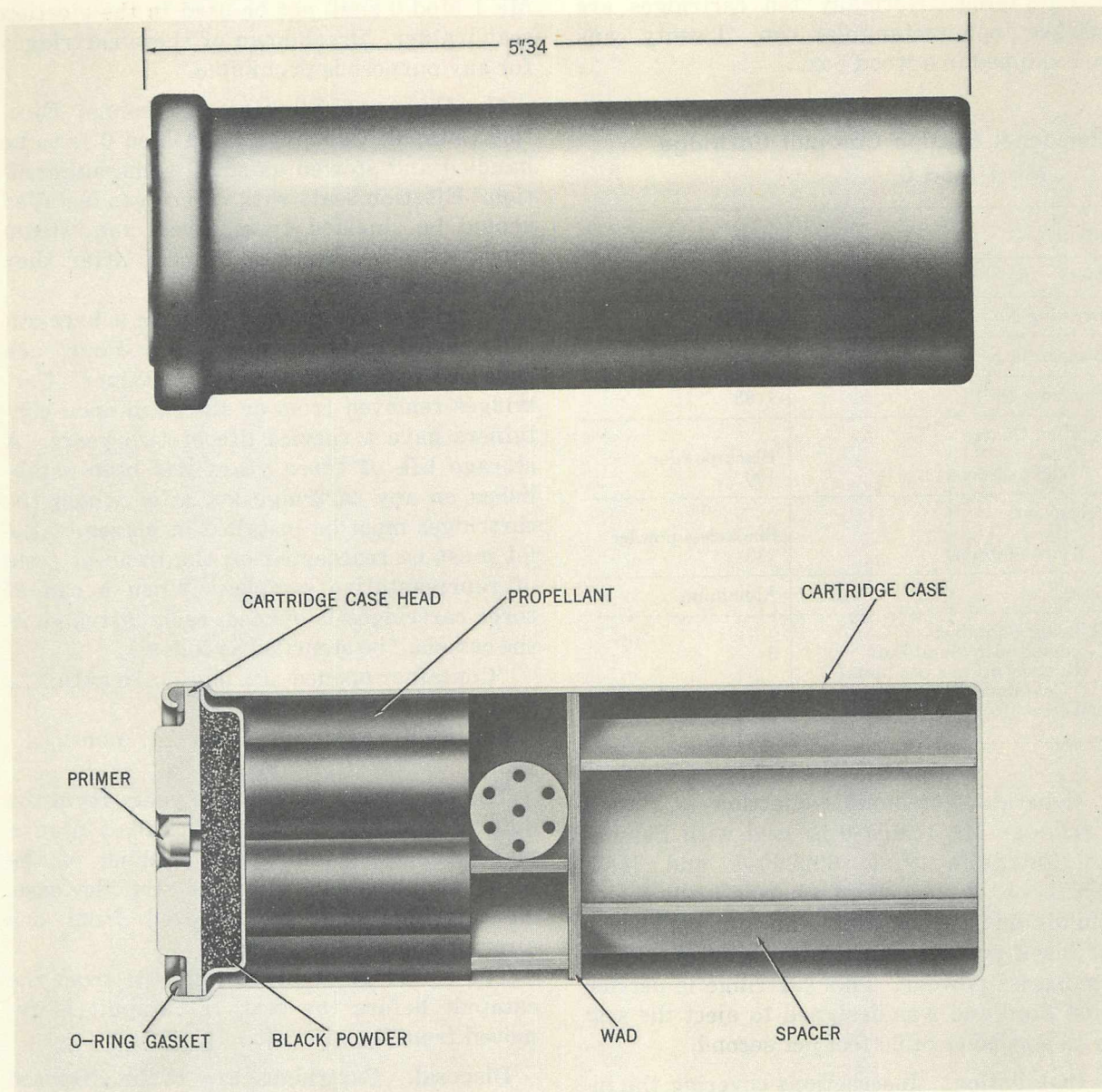


Figure 8.3—Personnel Ejection Catapult Cartridge Mk 2 Mod 0, External View and Cross Section.

**Handling and Stowage.** Personnel Ejection Catapult Cartridge Mk 2 Mod 0 is to be handled and stowed as small arms ammunition. The cartridges should be shielded from direct sun, steam pipes, and other sources of heat.

**General.** Personnel Ejection Catapult Cartridge M28A1 is used on the M1A1 and M5 aircraft personnel catapults. It consists

of an aluminum case containing a percussion primer, an ignition charge, and a propelling charge. The open end of the case is sealed with a thin aluminum disc and sealing ring.

**Operation.** When the cartridge is fired, the expanding gases from the burning propellant force the three cylinders of the catapult to extend and eject the seat from the aircraft.



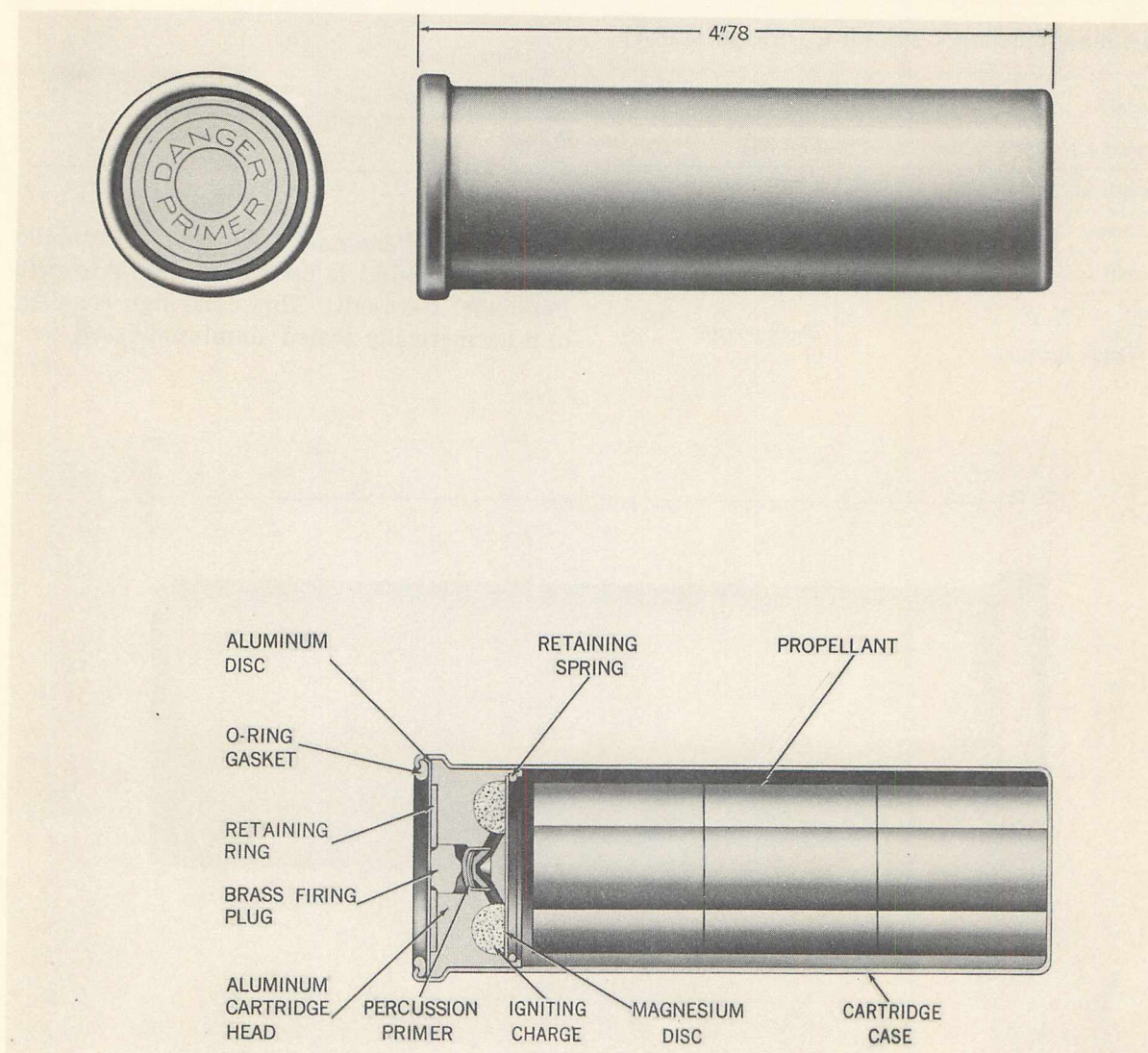


Figure 8.4—Personnel Ejection Catapult Cartridge M28A1, External View and Cross Section.

#### Personnel Ejection Catapult Cartridge Mk 2 Mod 0

Mk	2
Mod	0
Drawing No.	433640
Length (in.)	5.34
Diameter (in.)	1.85
Weight (lb)	0.5
Ignition Charge Type Weight (grains)	Black powder 100

Propelling Charge Type Weight (grams)	Smokeless powder 69.2
Case	Aluminum
Shipping Container Number of Rounds Type Weight (lb)	12 Wood 22

**Handling and Stowage.** The cartridges are handled and stowed as small arms ammunition.



## Personnel Ejection Catapult Cartridge M28A1

Model	M28A1
Drawing No.	75-1-277
Length (in.)	4.78
Diameter (in.)	1.50
Weight (oz)	5.44
Ignition Charge Type Weight (grains)	Black powder 67

Propelling Charge  
Type  
Weight (grams)

Propellant powder  
84.5

Primer

M61

**General.** Personnel Ejection Catapult Cartridge M36A1 is used in the M3 Aircraft Personnel Catapult. This cartridge consists of a hermetically sealed aluminum cased car-

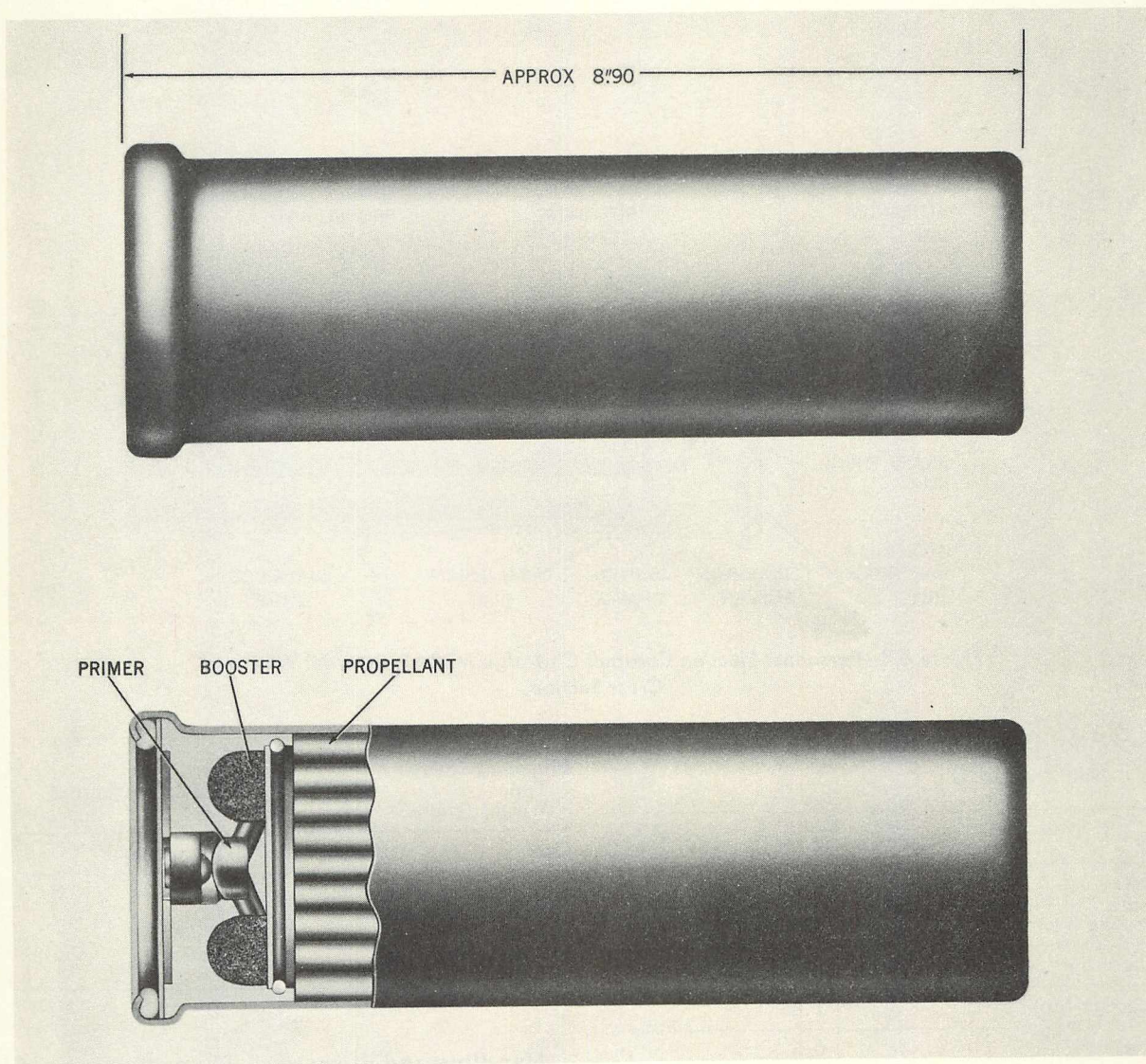


Figure 8.5—Personnel Ejection Catapult Cartridge M36A1, External View and Cross Section.



## Personnel Ejection Catapult Cartridge M36A1

Model	M36A1
Drawing No.	BLX-29-1
Length (in.)	8.9
Percussion Primer	M61
Ignition Charge Type Weight (grains)	Black powder 65
Propelling Charge Type Weight (grams)	Smokeless powder 200

tridge loaded with an ignition charge of black powder and a propelling charge of smokeless powder. It is percussion fired.

**Handling and Stowage.** The cartridge is to be handled and stowed as small arms ammunition in accordance with the provisions of OP 5. Ejection seats with cartridges installed should be shielded from direct sun, steam pipes, and other sources of heat when removed from the aircraft.

The cartridges are packed three to a hermetically sealed tearstrip metal can and four such cans to a metal container.

When a cartridge is installed in an aircraft, the Bureau of Aeronautics requires that an entry shall be made in the aircraft log in accordance with Bureau of Aeronautics Technical Order 17-53 of 13 March 1953. No cartridge shall be removed from one plane and used in another.

**Disposal.** Instructions for disposition of unserviceable or replaced cartridges will be found in OP 5. Breakdown of these cartridges for any purpose is prohibited.

**General.** Bomb Ejector Cartridge Mk 1 Mod 2 is used in the Douglas bomb ejector. It provides force to push bombs far enough from aircraft so that they will clear the propeller when the aircraft is in a diving attitude.

Although the heaviest bombs with which this ejection cartridge is used will be

## Bomb Ejector Cartridge Mk 1 Mod 2

Mk	1
Mod	2
Drawing No.	398796
Length (in.)	3.42
Diameter (in.)	1.05
Weight of Bomb Displaced (lb) Maximum Minimum	2000 325
Propelling Charge Type Weight (grams)	Smokeless powder 26.4
Booster Type Weight (grains)	Black powder 34
Shipping Container Number of Cartridges Type Weight (lb)	26 Fiberboard 4.3

launched successfully at diving attitudes up to 80°, the cartridge was designed for medium-weight bombs over 325 pounds and with these bombs will operate successfully at angles up to 90°. Aircraft torpedoes can be launched in level flight by the use of these cartridges. If they are used with bombs lighter than the designed weight, either the bomb or the ejector may be damaged.

The cartridge consists of a rimmed bushing containing an electric primer and a charge of powder. One end of the cartridge is covered by a cap which must be removed before use.

**Operation.** The cartridge is fired by an electric current through a switch so that it will eject the bomb at the proper time to hit a designated target. The primer ignites the ejection charge.

**Identification.** Nomenclature and lot number are stamped on the bushing. The cap is marked "REMOVE CAP BEFORE USING."

**Safety Precautions.** Do not substitute aircraft jet engine starter cartridges for Bomb Ejection Cartridges Mk 1 Mod 2 in the Douglas bomb ejector.



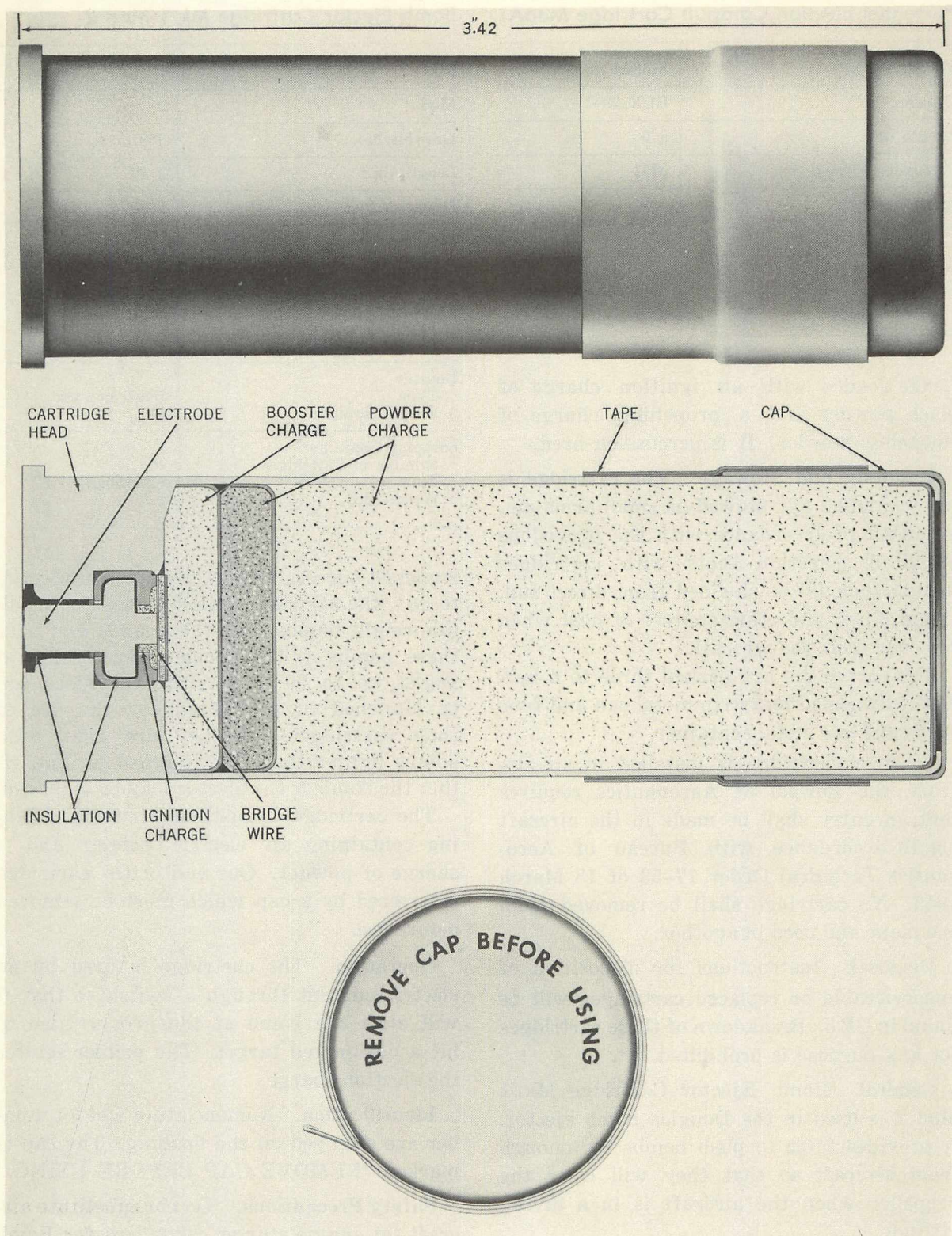


Figure 8.6—Bomb Ejector Cartridge Mk 1 Mod 2, External View and Cross Section.



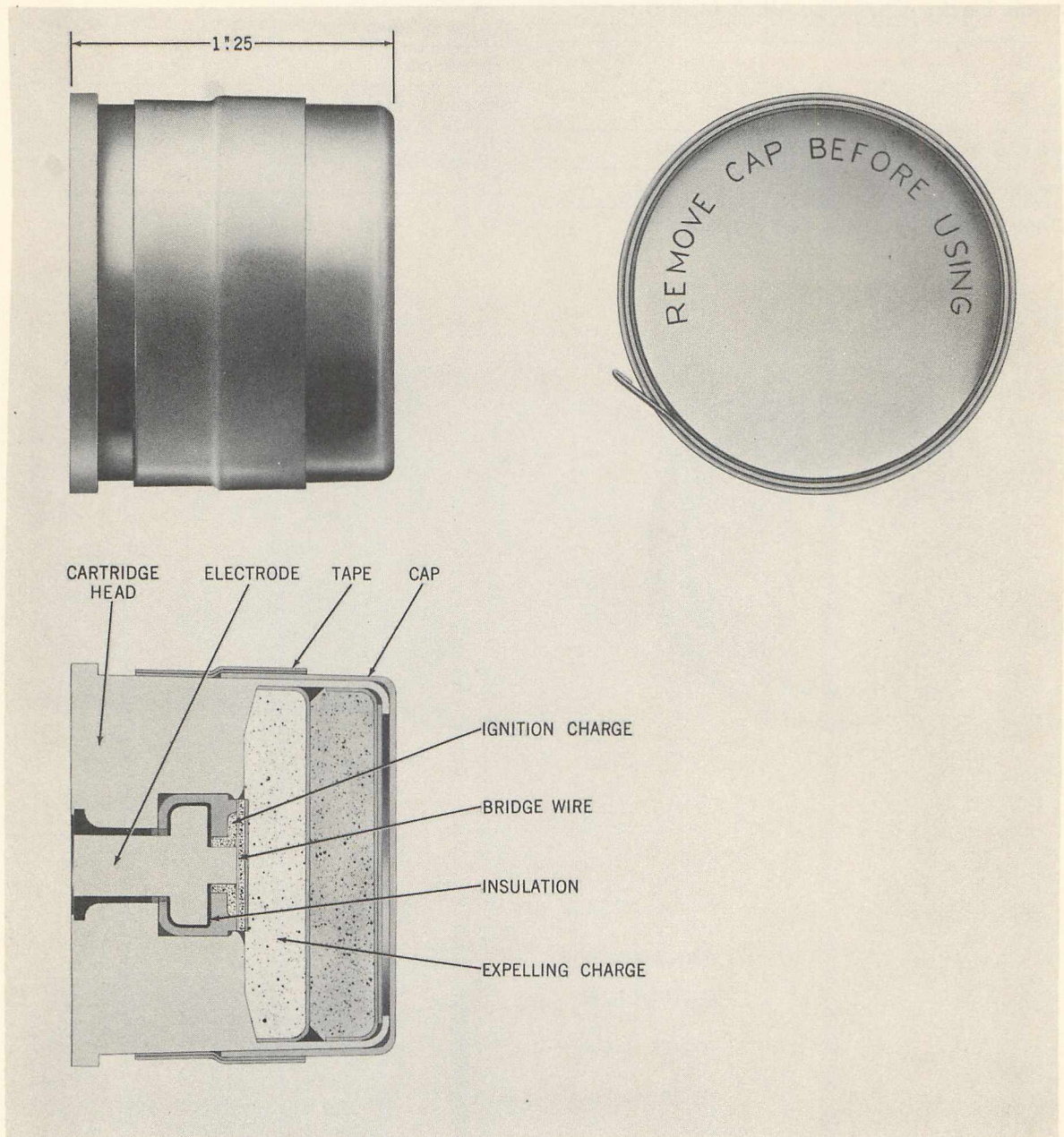


Figure 8.7—Bomb Ejector Cartridge Mk 2 Mod 0, External View and Cross Section.

**General.** Bomb Ejector Cartridge Mk 2 is used in the Douglas bomb ejector. It provides force to push bombs far enough from aircraft so that they will clear the propeller when the aircraft is in a diving attitude.

This cartridge has been designed to be used for the ejection of bombs of 325 pounds or less, and water-fillable practice bombs,

which would be damaged, or the ejector damaged, by the use of a cartridge with a larger charge of powder.

The cartridge consists of a rimmed bushing containing an electric primer and a charge of powder. One end of the cartridge is covered by a cap which must be removed before use.



## Bomb Ejector Cartridge Mk 2 Mod 0

Mk	2
Mod	0
Drawing No.	881008
Length (in.)	1.25
Diameter (in.)	1.05

Weight of Bomb Displaced (lb)	
Maximum	325
Minimum	58
Shipping Container	
Number of Rounds	65
Type	Metal
Weight (lb)	5.5

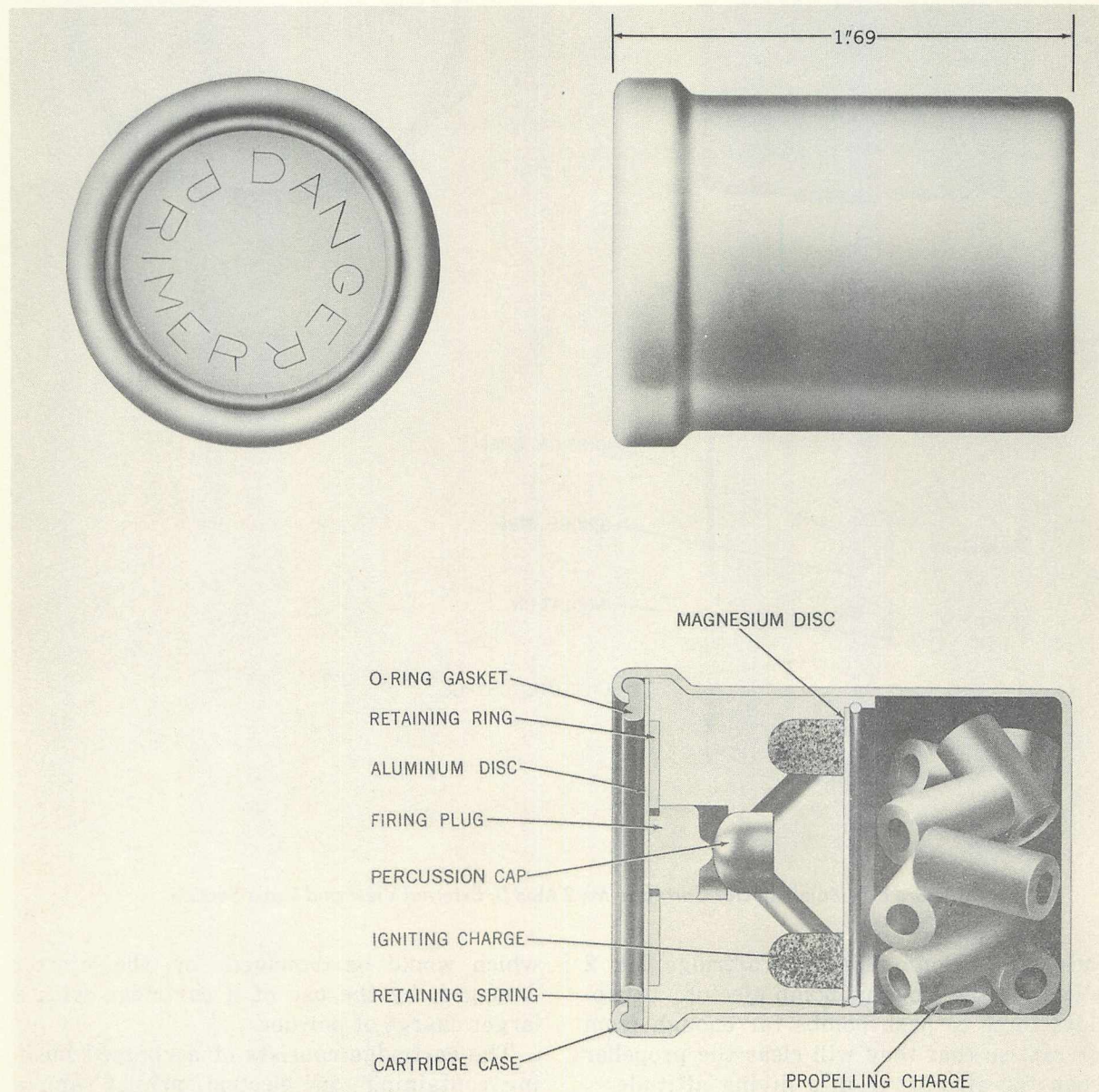


Figure 8.8—Aircraft Canopy Remover Cartridge M29A2, External View and Cross Section.



**Operation.** The cartridge is fired by an electric current through a switch so that it will eject the bomb at the proper time to hit a designated target. The primer ignites the ejection explosive charge.

**Safety Precautions.** Do not substitute aircraft jet engine starter cartridges for Bomb Ejector Cartridge Mk 2 in the Douglas bomb ejector.

**General.** Aircraft Canopy Remover Cartridge M29A2 is for use in Canopy Remover M1A1.

The cartridge consists of an aluminum case containing a percussion primer, an igniting charge, and a propelling charge. The

### Aircraft Canopy Remover Cartridge M29A2

Model	M29A2
Drawing No.	75-1-280
Length (in.)	1.69
Diameter (in.)	1.25
Percussion Primer	M61
Ignition Charge Type Weight (grams)	Black powder 1.7
Propelling Charge Type Weight (grams)	Smokeless propellant M2 7.8

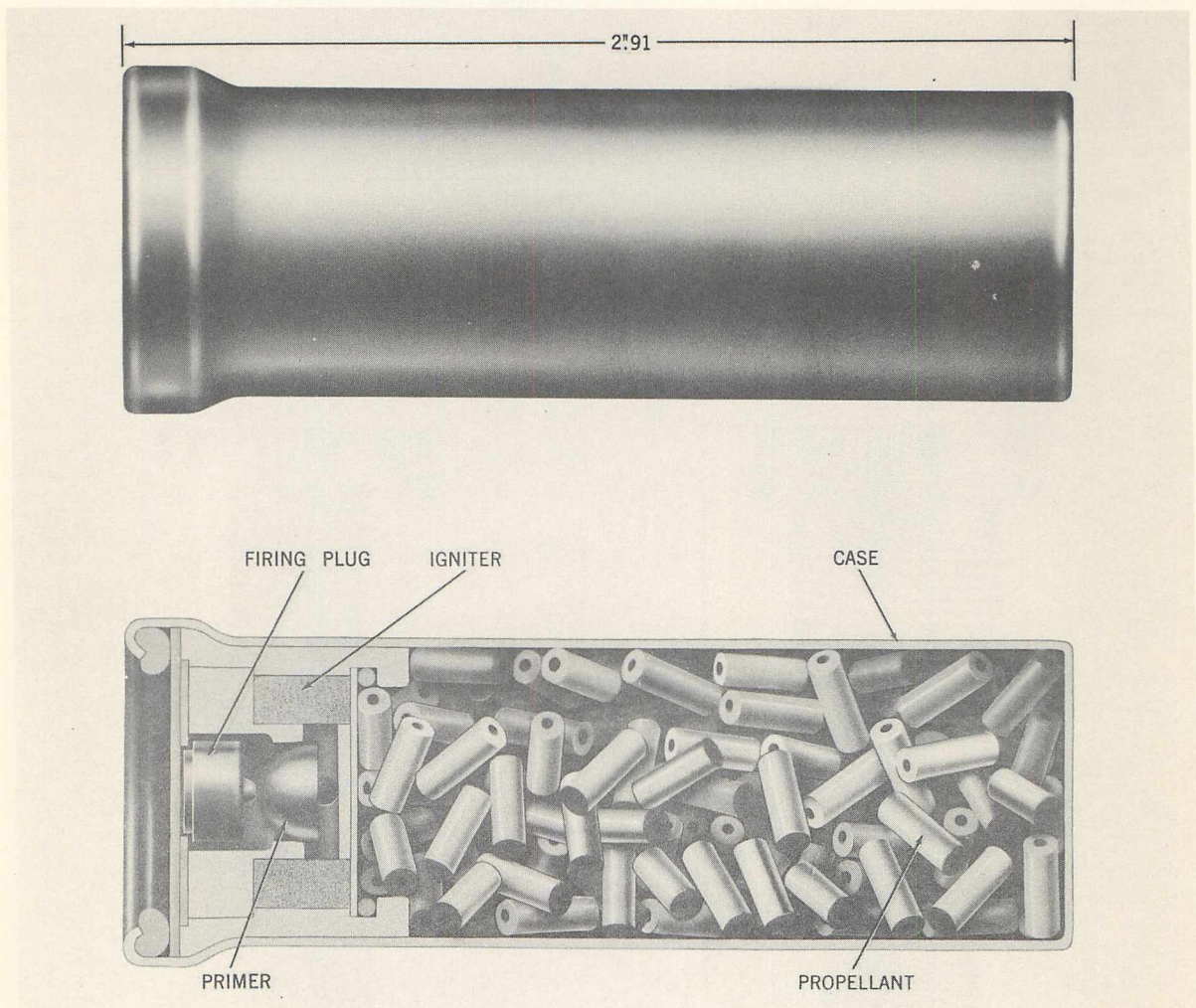


Figure 8.9—Aircraft Canopy Remover Cartridge M31A1, External View and Cross Section.



open end of the case is sealed with a thin aluminum disc and sealing ring.

**Operation.** When the cartridge is fired, the expanding gases from the igniting and propelling charges force the three cylinders of the remover to extend and open the canopy.

**Handling and Stowage.** The cartridges are handled and stowed as small arms ammunition.

#### Aircraft Canopy Remover Cartridge M31A1

Model	M31A1
Drawing No.	75-1-290
Length (in.) Percussion Primer	2.91 M61
Ignition Charge Type Weight (grams)	Black powder 1.7
Propelling Charge Type Weight (grams)	Smokeless propellant 23
Shipping Container Number of Cartridges Type	12 Metal

**General.** Aircraft Canopy Remover Cartridge M31A1 is used in Aircraft Canopy Removers M2A1 and M3. The item consists of a hermetically sealed aluminum case cartridge of black powder and a propelling charge of smokeless powder.

**Packaging.** Three cartridges are packed in a hermetically sealed tearstrip can and four such cans are packed in a metal container.

**Handling and Stowage.** The cartridges are handled and stowed as small arms ammunition.

#### Primer (Electric) Mk 25 Mod 0

Mk	25
Mod	0
Drawing No.	1283673
Length (in.)	1.58
Ignition Charge Type Weight (grains)	Black powder 30

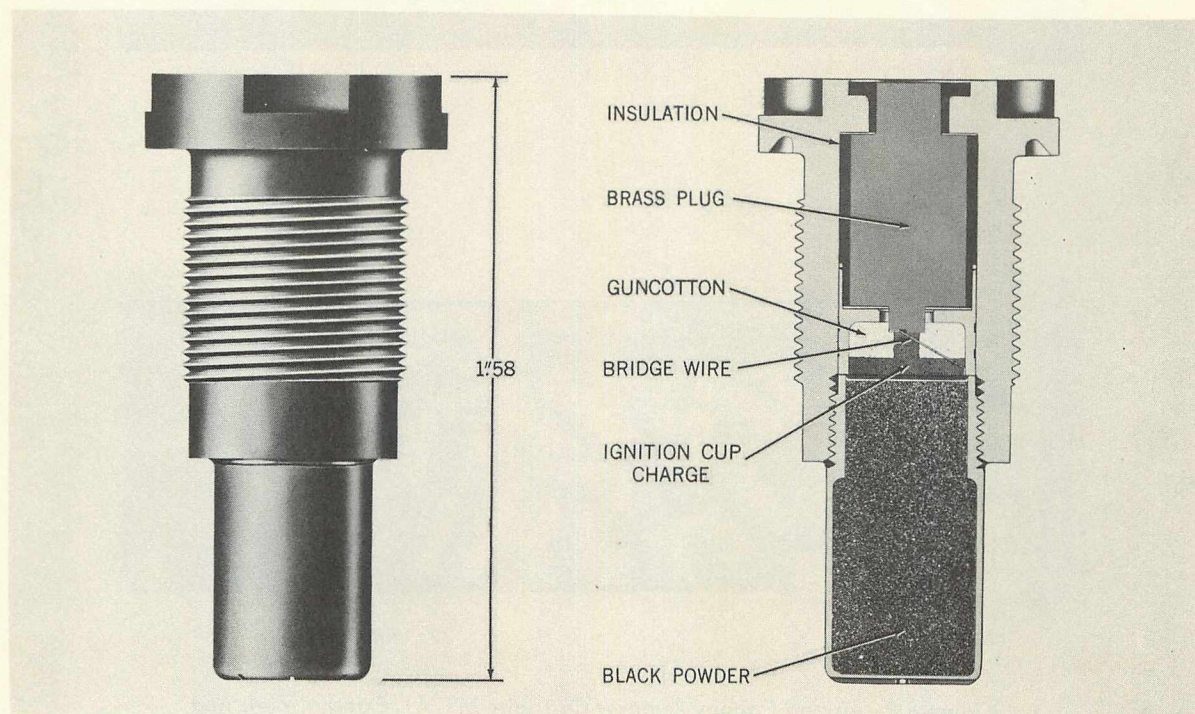


Figure 8.10—Primer (Electric) Mk 25 Mod 0, External View and Cross Section.



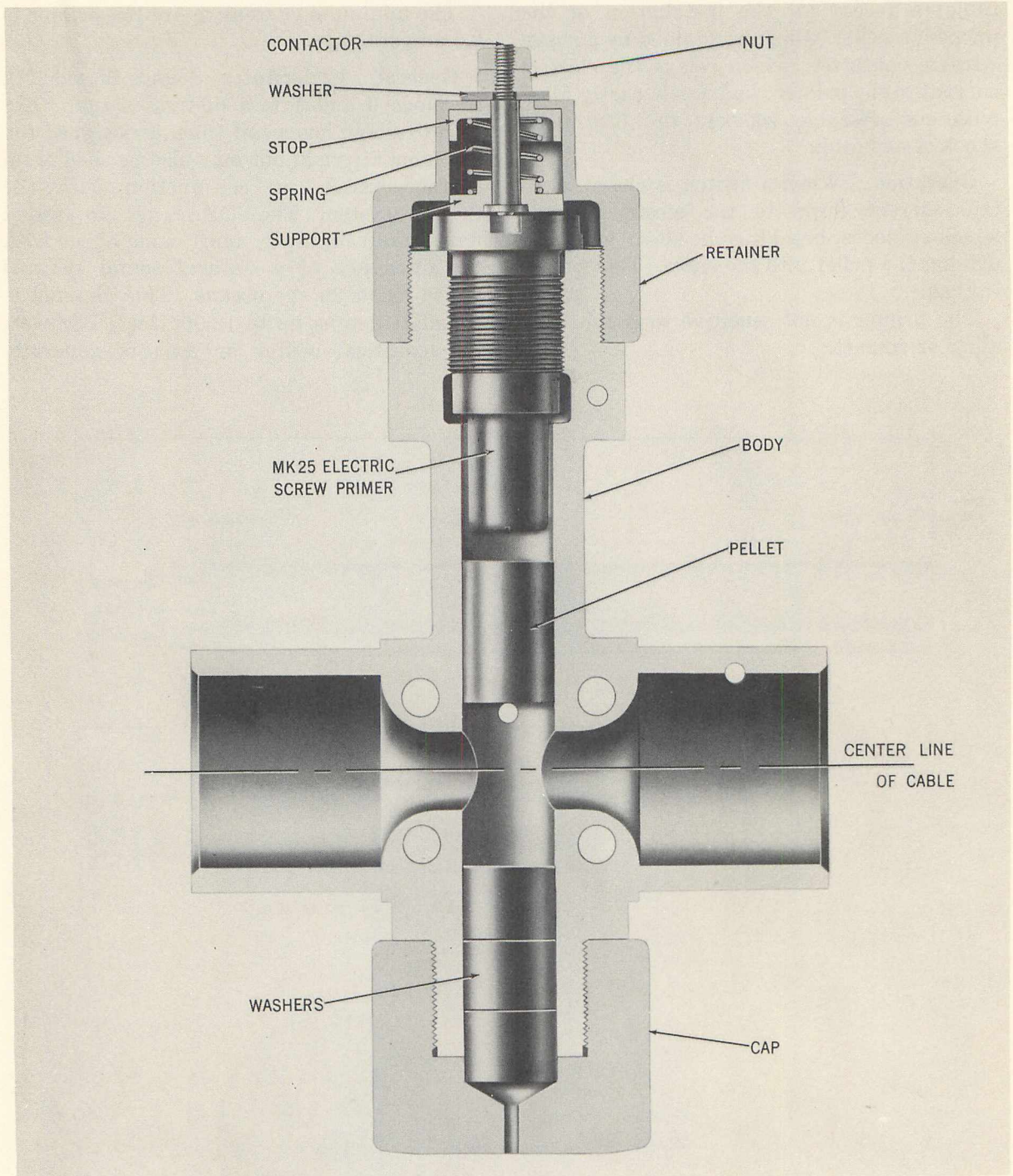


Figure 8.11—Aircraft Explosive Cable Cutter, Cross Section.

**General.** Primer (electric) Mk 25 Mod 0 is used in Explosive Cable Cutter Mk 8 Mod 0. The cutter is used in conjunction with Tow Reel Mk 8 Mod 0 on airplane tow target

installations. It is located aft of the cable reel and can be electrically operated by either the pilot or the reel operator. The cutter consists of: a body, with an opening for the



cable; a recess for the installation of the primer; a pellet, which is retained by a shear wire; a contactor, which relays the electric current to the primer; and a hole partly filled with compressable washers to absorb the shock of explosion.

**Operation.** When a switch is closed, electric current flows to the electric primer which explodes, breaking the shear wire and driving the pellet into the cable. This severs the cable.

The primer is not sensitive to rough handling or impact.

The minimum current to fire the primer is 0.5 ampere.

**General.** Underwater Sound Signal Mk 22 Mods 0 and 1 is a distress signal. The Mod 0, which has a tail vane, is designed for use from aircraft, but may also be used from surface vessels, in conjunction with the SOFAR system. The SOFAR system (sound fixing and ranging system) came about with the discovery of a natural sound channel which exists in the oceans. This channel is found at depths up to 12,000 feet; however, the acoustical center or axis is generally

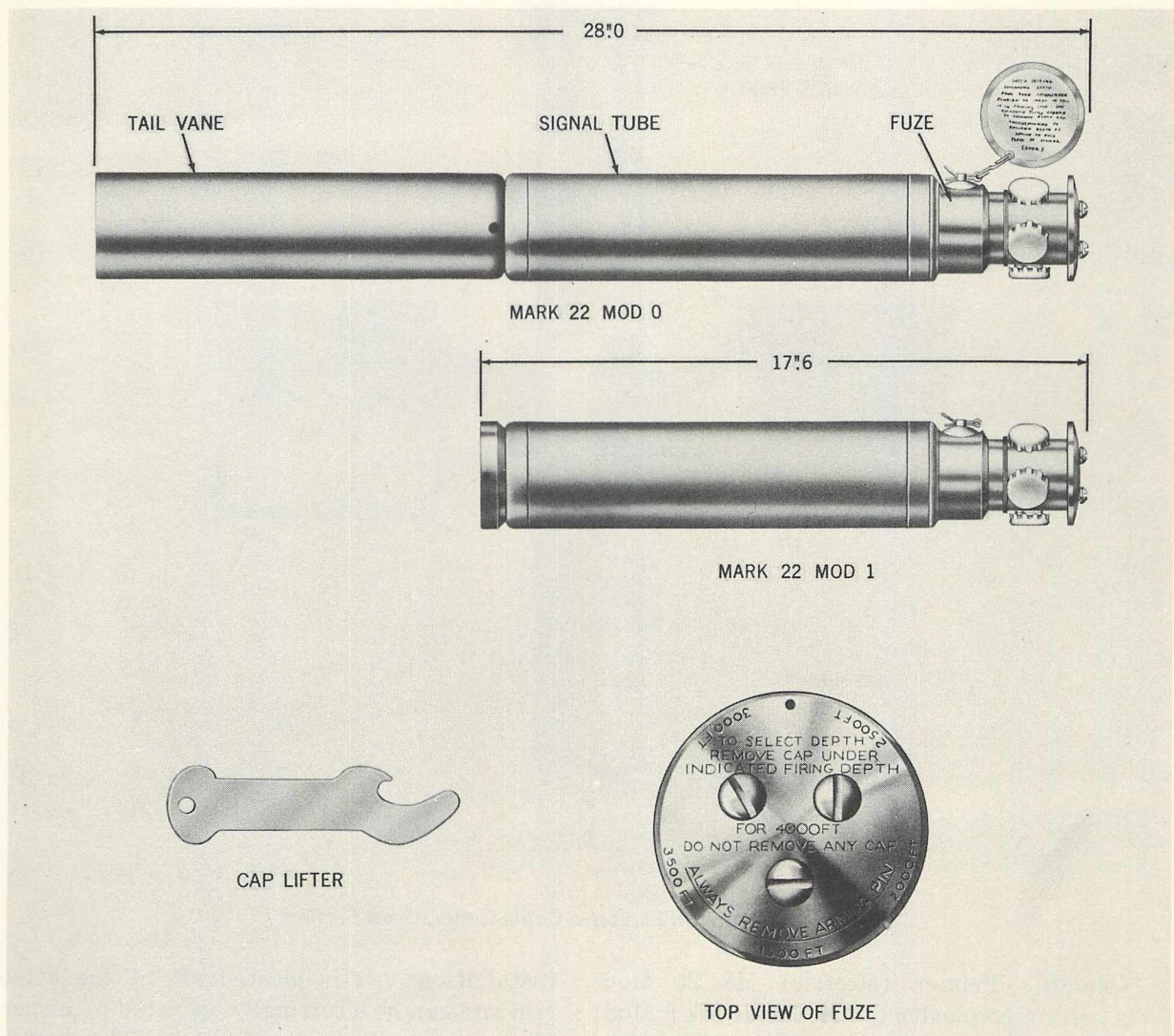


Figure 8.12—Signal (Underwater Sound) Mk 22 Mods 0 and 1, External View.



## Signal (Underwater Sound) Mk 22 Mods 0 and 1

Mk	22	22
Mod	0	1
Drawing No.	554891	554891
Overall Length (in.)	28	17.6
Maximum diameter (in.)	3	3
Weight (lb)	13.4	12.75
Explosive Charge Type Weight (lb)	TNT 4	TNT 4
Terminal Sinking Velocity (fps)	14	9
Use	Aircraft, Surface craft	Surface craft
Fuze Mk Mod Length (in.)	175 0 5.375	175 0 5.375
Shipping Container Number of Rounds Type Weight (lb)	4 Wood box 56.0	4 Wood box 53.5

found between 1500 and 4000 feet below the surface. The sound from a small bomb detonated near this axis can be received by a monitoring station at ranges up to 3000 miles. The monitoring or listening stations are designed to receive distress signals produced by Signal (Underwater Sound) Mk 22. Since the various listening stations are synchronized in time, it is possible to determine the approximate location of the source of a sound signal.

**Description.** Each signal consists of the body part or signal tube, containing 4 pounds of TNT, and Fuze Mk 175 Mod 0, which is screwed on to the nose end of the tube. Addition of the tail vane to the other end of the body identifies the Mod 0 signal. Before the signal is launched or dropped overboard, the cotter pin that locks the arming plunger must be removed. As long as the arming plunger protrudes through the diaphragm retainer, the fuze is unarmed and safe. If the signal is to explode at a depth of 1500, 2000, 2500, 3000, or 3500 feet, the bottle cap that covers the appropriate depth-setting port is taken off by means of

the attached bottle opener. This exposes a rupture disc that closes the inner end of the port. Depth settings are indicated on the nose plate. If the signal is to detonate at 4000 feet, no cap is removed, since at this depth sea water will operate the fuze through an open port directly below the nose plate.

When the signal reaches the desired depth, the exposed disc is ruptured and sea water fills the fuze-head cavity, exerting pressure on the firing diaphragm. The firing diaphragm is snapped forward and causes the shear wire, which holds the stab-type firing pin in place, to give way. The firing pin then strikes the detonator.

The detonator remains in the safe position, even after removal of the safety cotter pin until, at a depth of between 750 and 1200 feet, the pressure of sea water acting on the arming plunger and on the stiff copper arming diaphragm moves the detonator permanently into the armed position. The arming plunger seats so that the detonator is alined between the firing pin and the lead-in to the booster. The explosive train fol-



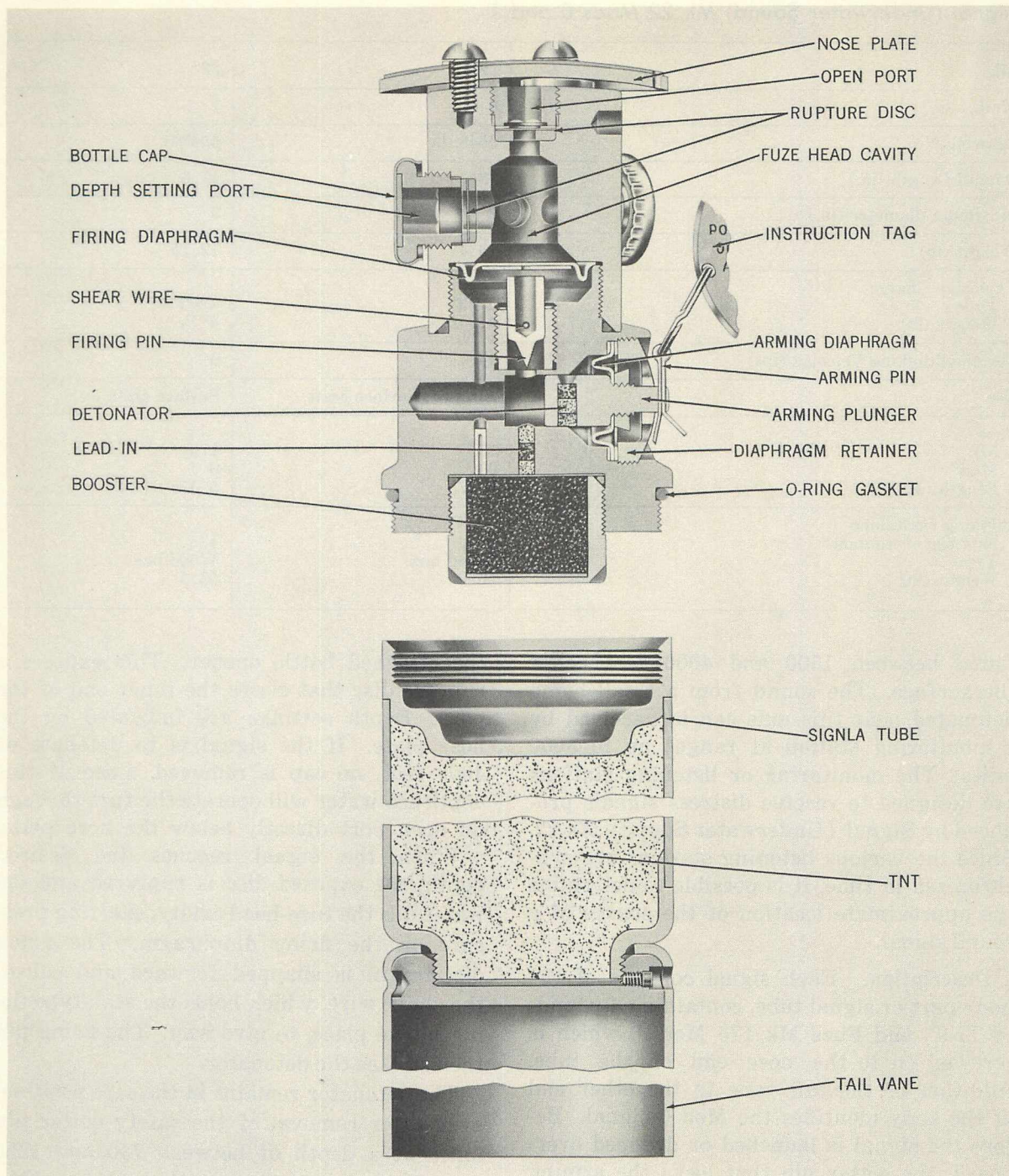


Figure 8.13—Signal (Underwater Sound) Mk 22 Mods 0 and 1, and Fuze Mk 175 Mod 0, Cross Section.



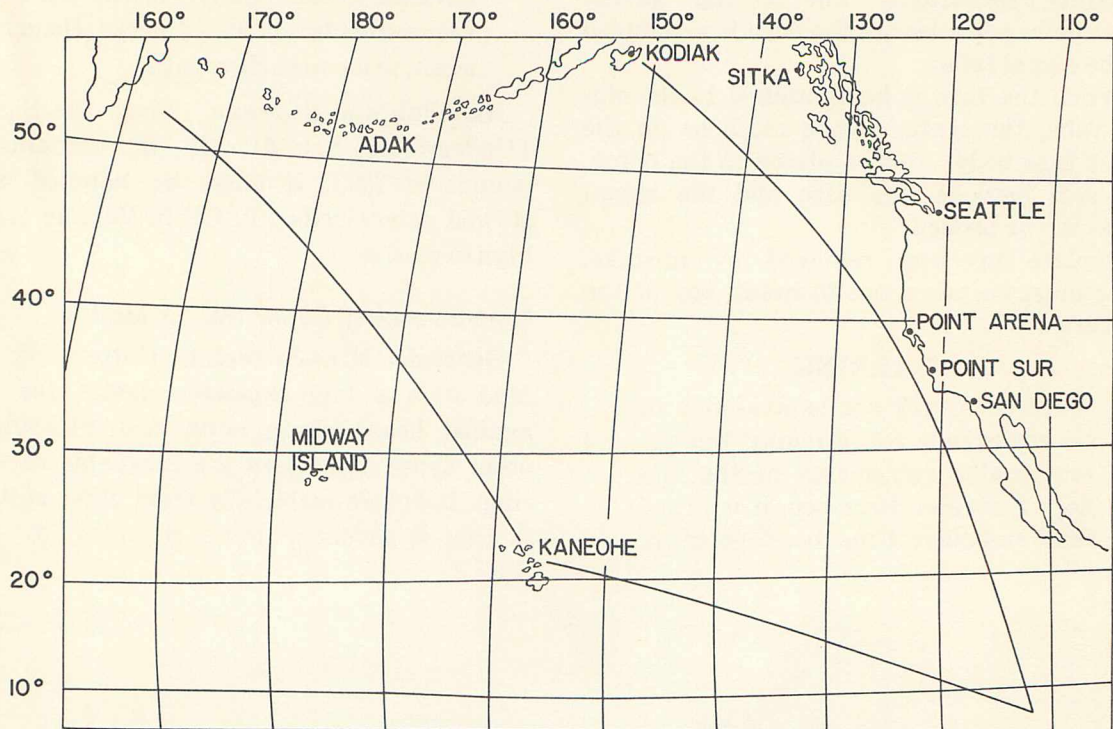


Figure 8.14—Limits of Reception of Present Three-Station SOFAR Network.

lows the path: detonator, lead-in, booster, and main charge.

**Preparation for Launching.** The following preparations should be made, or it should be determined that they have already been made, prior to departure.

1. Screw Fuze Mk 175 Mod 0 into the signal body until it makes a metal-to-metal contact.

2. Locate the slots in the fuze end of the signal tube. In line with one of these slots, place the point of a center punch on the fuze body rim just inward from its edge adjacent to the signal tube. Stake some metal from the fuze body rim into the slot. Repeat this operation at the other slot.

3. Be sure that the tail vane is screwed on if the signal is being carried in aircraft.

The following should be done just prior to use of the signal.

1. Remove the bottle cap from the depth-setting port under the appropriate depth indicated on the nose plate. If a depth

setting of 4000 feet is desired, no bottle cap should be removed. Figure 8.14 shows the area covered by the three-station SOFAR network in the northeast Pacific Ocean. A depth setting of 2000 feet should be used throughout this area.

2. Remove the safety cotter pin.

3. Drop the signal (over the side if from a surface vessel; through the signal ejection tube if from a plane).

**Instruction Tag.** The following information is contained on the instruction tag.

“Depth setting. Determine depth from your approximate position on chart in tail or in packing case. Use attached bottle opener to remove bottle cap corresponding to desired depth as shown on nose plate of signal.”

“Before hand dropping or placing in launching gear, remove tag and attached cotter pin, set depth. If signal is not dropped, replace cotter pin at once, or immediately after removing from launching gear.”



**Safety Precautions.** The O-ring gasket must be in place before the fuze is assembled to the signal tube.

When the fuze is being staked to the signal tube, the center punch must be on the brass fuze body. If it is placed in the notch, the seal between the fuze and the signal tube may be broken.

Replace any cap removed by mistake. Care must be taken not to break any of the rupture discs.

### WARNING

Since time may not be available in an emergency for learning the operational requirements of the signaling devices described, it is urged that sufficient time be devoted in

advance to such study. Learn these requirements now. Check them again prior to each voyage.

**Handling and Stowage.** Since the Signal (Underwater Sound) Mk 22 contains 4 pounds of TNT, it must be handled and stowed as prescribed in OP 5, Volume 1, for high explosive.

### Mine-Sweeping Cutter Mk 13 Mod 0

**General.** Mine-Sweeping Cutter Mk 13 Mod 0 is a high-explosive device for use against heavy chain mine moorings which other types of cutters are incapable of cutting. It differs materially from other cutters in that it severs a mine mooring by the

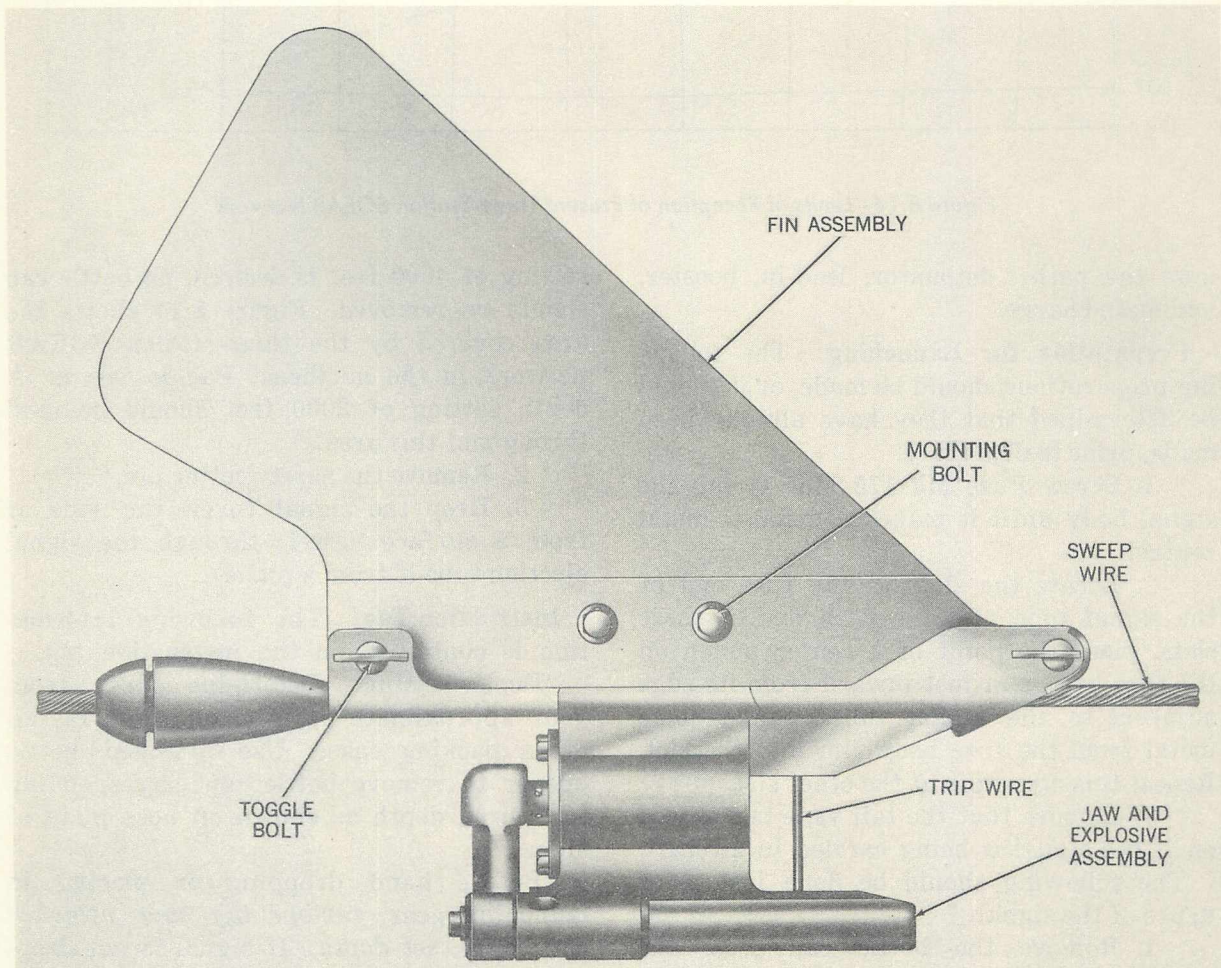


Figure 8.15—Mine-Sweeping Cutter Mk 13 Mod 0, External View.



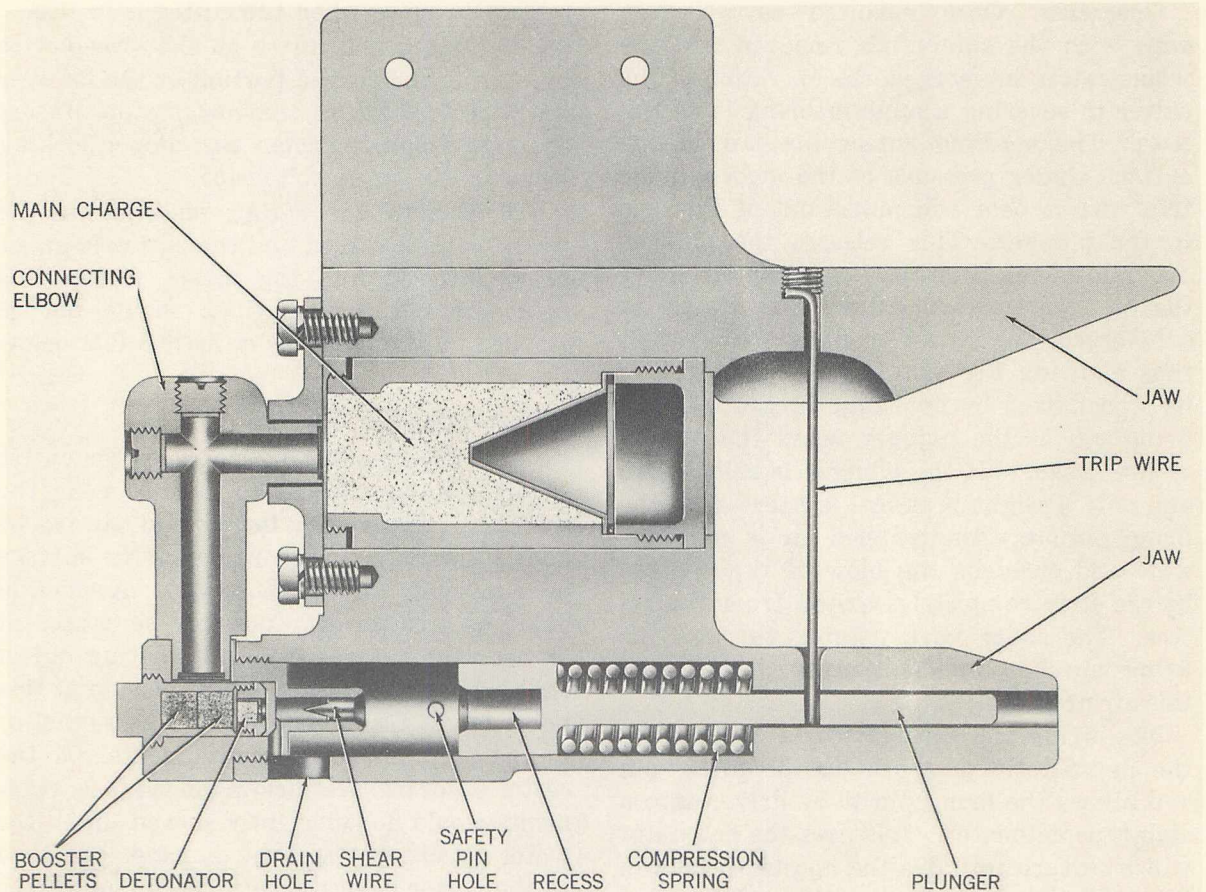


Figure 8.16—Jaw and Explosive Assembly of Mine-Sweeping Cutter Mk 13 Mod 0, Cross Section.

direct force of the explosion rather than by the use of a knife or cutting punch.

The cutter, like other explosive cutters, is designed to be mounted on a sweep wire in such a way that a mine mooring is swept into the jaws of the cutter where it activates a trip wire. The trip wire initiates the explosive train terminating in the detonation of the main explosive charge, which is so arranged as to cut the mine mooring.

When fired, the entire cutter is destroyed. Only the fin is left on the sweep wire. Because of the directed effect of the explosion, the sweep wire will not be damaged.

**Description.** The cutter consists of a fin assembly, a jaw assembly, and a detonator unit. The fin assembly has two mounting-bolt holes for securing the jaw assembly and

two toggle bolts for securing the sweep wire. The jaw assembly contains a shaped charge of pentolite, an explosive-filled connecting elbow, a well for receiving the detonator unit, and a firing pin held in place in its tube by a shear wire. There are a number of drain holes between the detonator-unit well and the firing-pin tube. In line with the firing pin is a spring-loaded plunger that is held in place by a trip wire. A spring-steel safety pin fits between the plunger and the firing-pin tube. The safety pin is wired in place. The end of the plunger contains a deep recess.

The detonator unit consists of a brass container that holds a stab-type detonator and two tetryl pellets.



**Operation.** Once mounted on a sweep wire with the safety pin removed and the whole cutter submerged, the operation of the cutter in severing a mine mooring is as follows. The mooring enters the jaw of the cutter. Under pressure of the mooring, the trip wire is bent and pulled out of the hole in the plunger. This releases the plunger and allows the compression spring to drive the plunger forward. Since the cutter is submerged, the recess is filled with water, thus allowing the motion of the plunger to be transmitted by hydraulic pressure to the firing pin as the plunger nears the bottom of its stroke. (If the plunger is released in air, only a slight pressure is exerted on the firing pin since the trapped air is compressible and cushions the blow of the plunger before it is completely vented from the recess. The shear wire passing through the firing pin has sufficient strength to resist this air pressure.)

The firing-pin shear wire is sheared by the hydrostatic pressure on the firing pin and allows the firing pin to be driven into a stab-type detonator. This fires the detonator which in turn initiates the booster pellets in the detonator unit. The resulting detonation sets off the explosive in the connecting elbow, which initiates the detonation of the main charge. Explosion of the charge cuts the mine mooring.

The design of the cutter provides sufficient metal between the charge and the sweep wire to prevent any lateral effect of the main explosion from damaging the sweep wire.

#### **Preparation for Use.**

1. Attach the jaw assembly to the fin assembly with two mounting bolts.

2. Test the safety pin by undoing the retaining wire and withdrawing the safety pin. Reinsert the safety pin and secure it again with the retaining wire.

3. Remove the detonator unit from its stowage box and screw it into the cutter. Do not do this until the cutter is to be placed on the sweep wire.

4. Tighten the detonator unit with a wrench just enough to insure that it will

remain in place when the cutter is in use.

5. Mount the cutter on the sweep wire by placing the curved portion of the fin over the wire forward of the wedge stop. Insert the toggle bolts. Fasten the copper locking strips in the toggle-bolt heads.

6. Remove the safety pin only as the sweep wire is veered and the cutter is about to be lowered into the water. From this point the sweep-wire winch should not be stopped until a cutter is at least 3 feet below the surface.

#### **Recovering the Cutter.**

1. When recovering the gear, the cutter should not be allowed to remain near the surface of the water, but should always be kept either 3 feet or more below the surface or completely out of the water. Accidental firing of a cutter may possibly be caused at or near the surface by some floating object striking the trip wire. Such explosion at this point might result in injury to personnel or to the ship from flying fragments. If the cutter is several feet below the surface, fragments would be sufficiently slowed up by the water to prevent serious damage. As soon as the cutter comes within reach, the safety pin should be reinserted. A safety pin that fits too loosely in the safety-pin hole should be slightly bent so that it will fit snugly.

2. Remove the cutter from the sweep wire.

3. Remove the detonator unit immediately.

4. Rinse the detonator unit with fresh water and carefully wipe it dry. Return it to stowage.

5. Rewire the safety pin in place.

6. Clean the plunger with a fresh-water hose so that it is free of mud, sand, and salt water. Allow the cutter to drain so that no water remains trapped in the plunger recess.

**CAUTION:** Do not attempt to clean a cutter that has a bent trip wire. If the trip wire is bent appreciably, it is not readily replaced or repaired. It is a possible source of accident.



**Disposing of the Cutter.** Make the following inspection before disposing of the cutter.

1. Reinsert the safety pin. If the safety pin cannot be reinserted, examine the safety-pin hole to see if it is obstructed by mud or by the plunger. Do not remove the detonator unit until the safety pin is in place.

2. If the plunger obstructs the safety-pin hole, examine the drain hole to see if the plunger has fired its full stroke. If it has, the cutter is safe for further handling.

3. If the plunger obstructs the safety-pin hole, and is not visible at the drain hole, the cutter is possibly dangerous for handling. Stuff a piece of cord into the hole and secure it by a few turns around the cutter to block the full stroke of the plunger in case it is freed during handling. If the drain holes are clogged with mud, and the safety-pin hole obstructed by the plunger, the cutter may be regarded as safe for disposition.

4. Remove the cutter from the sweep wire.

5. Only when the safety pin has been reinserted may the detonator unit be removed. The cutter is marked "unserviceable" and disposed of in accordance with current BuOrd directives. If the safety pin cannot be reinserted, the detonator unit is not removed. In this case the cutter, with the detonator unit still installed, is removed from the sweep wire and placed in a suitable container lined with old rags or other soft material for disposition overboard at the first opportunity.

In case the Commanding Officer decides that the situation justifies immediate disposition of the cutter while in the sweeping area, such disposition may be made at his discretion.

Disposition overboard of unserviceable cutters, including those with bent trip wires, should preferably be made in water not less than 500 fathoms deep and not less than 10 miles from shore. In case operations are being conducted in waters where this depth is not available or will not be available before returning to base, deep water of less than 500 fathoms in a suitable isolated location may be used at the discretion of the Com-

manding Officer instead of retaining the unserviceable cutter on board. Cutters with detonator units in place must not be returned to the magazine.

**Maintenance.** Very little maintenance is required except the flushing necessary whenever the cutter is removed from water prior to restowing. The entire cutter is made of noncorrosive materials and requires no maintenance to protect it against rusting. The use of oil and grease is unnecessary and undesirable as it may interfere with the operation of the hydraulic safety feature.

No disassembly (other than the removal of the detonator unit and the safety pin) and no repair of this cutter should be attempted. In the event of a bent trip wire, do not attempt repair, but dispose of the cutter as directed.

**Handling and Stowage.** Handle and stow the explosive-loaded jaw assembly in the same manner as bomb-type ammunition. See OP 4 and OP 5. Provision should be made to prevent shifting of the cutter caused by motion of the ship. Cutters may be stowed in their shipping crates.

Detonator units will be handled and stowed in accordance with the regulations for detonators in OP 4 and OP 5. Detonators are packed in special containers suitable for stowage in the metal detonator lockers aboard ship. Each container holds four detonator units properly spaced.

**Safety Precautions.** It is extremely important that the safety precautions listed below and the safety precautions for handling and stowage of explosives be observed at all times when using this cutter.

Before installing the detonator unit, check the safety pin by removing it and reinserting it.

Do not insert the detonator unit until the cutter is ready to be mounted on the sweep wire.

With the detonator unit in place, do not remove the safety pin until the cutter is ready to be lowered into the water.

Do not stop veering the sweep wire until the cutter is at least 3 feet below the surface



of the water, or unless the cutter is still well above the surface.

Although the main charge is a shaped charge so arranged that the principal forces are directed to cut a mine mooring, blast and fragment hazards exist in all directions regardless of the direction in which the cutter is turned.

When recovering gear, do not stop hauling in the sweep wire while the cutter is less than 3 feet below the surface, or until the cutter is well above the surface.

Insert the safety pin as soon as the cutter is within reach.

If the trip wire is bent appreciably, insert the safety pin into the safety-pin hole, if it can be inserted. If the safety pin cannot be inserted, follow the instructions for disposing of the cutter.

When the safety pin has been inserted,

remove the detonator unit as soon as the cutter is on deck.

Do not clean the cutter before removing the detonator unit and wiring the safety pin in place.

After cleaning, make sure that all water has drained from the plunger recess by holding the cutter with the jaws up.

If there is any reason to believe that water may have accumulated in the plunger cup while the cutter is on deck, allow the water to drain out before inserting the detonator unit.

Do not attempt to repair or disassemble either the cutter itself or the detonator unit.

When not submerged, protect the cutter and the detonator unit from prolonged exposure to the direct rays of the sun or abnormal temperatures.

Do not drop or handle the cutter roughly.



## Chapter 9

# DISPOSITION OF PYROTECHNICS AND MISCELLANEOUS EXPLOSIVE ITEMS

### General

The inherent hazards of the pyrotechnics and miscellaneous explosive items described in this OP are often increased by such factors as age, deterioration, damage, or other causes of unserviceability. Because of these added hazards, and other considerations, pyrotechnics and explosives, regardless of type or condition, shall not be disposed of without specific authorization and instructions from the Bureau of Ordnance in each instance. When the Commanding Officer of a ship or station decides that immediate disposition of dangerously deteriorated or damaged pyrotechnics or explosives is necessary in order to protect life and property, the Bureau of Ordnance shall be contacted by the quickest available means, and disposition instructions will be issued promptly.

Pyrotechnics may be disposed of in either of two ways—by burning, or by dumping in deep water. Certain items must always be burned, certain other items must always be dumped, while still other items may be either burned or dumped. The burning or dumping must be carried out in accordance with the specific instructions contained in chapter 29 of OP 5, Volume 1, for the item being burned or dumped. Photoflash bombs, photoflash cartridges, and pyrotechnics not mentioned in this OP shall be disposed of in accordance with specific instructions from the Bureau of Ordnance.

This publication does not constitute authority for the disposal of pyrotechnics or explosive items or their components by dumping, burning, detonating, or any other means, except in an emergency when in the Commanding Officer's opinion immediate action is necessary to prevent injury, loss of

life, or damage to property or equipment.

Normally, unserviceable pyrotechnics and explosive items are turned in to a Shore Establishment in accordance with OP 4. However, when circumstances dictate, and such munitions must be jettisoned, the appropriate provisions of NAVORD Instruction 8026.9, "Procedures for Disposal of Ammunition by Dumping in Deep Water," of 18 December 1956 apply.

NAVORD Instruction 8026.8A of 7 November 1956 provides disposal instructions for shore activities.

### Items Requiring Burning.

**PYROTECHNICS.** The following pyrotechnics must be disposed of only by burning, and never by dumping:

Night Drift Signal Mk 5 Mod 4

Aircraft Float Lights Mk 6 and Mods

Distress Smoke Hand Signals Mk 1  
Mod 0 and AN-Mk 1 Mod 1

Day and Night Distress Signals Mk 13  
Mod 0

**MISCELLANEOUS EXPLOSIVE ITEM.** The following miscellaneous explosive item must be disposed of only by burning, and never by dumping:

Primer (Electric) Mk 25 Mod 0

### Items Requiring Dumping.

**PYROTECHNICS.** The following pyrotechnics must be dumped at sea and must not be destroyed by burning:

Aircraft Parachute Flares Mk 4 and  
Mods, Mk 5 and Mods, Mk 6 and  
Mods, and Mk 8 and Mods

High Altitude Parachute Flare Mk 20  
Mod 0



Trip Parachute Flare M48  
 Trip Flare M49  
 Trip-Wire Flare Mk 1 Mod 0  
 Depth Charge Markers Mk 1 and Mods,  
 and Mk 2 Mod 0  
 Marine Markers Mk 7 Mod 2, Mk 8 Mod  
 0, and Mk 9 Mod 0  
 Slick Marker Cartridge AN-Mk 1 Mod 0  
 Slick Marker AN-M59  
 Aircraft Red Star Parachute Signal M11  
 Aircraft Double-Star Signals AN-M37  
 to AN-M42 Series and AN-M37A1  
 to AN-M42A1 Series  
 Aircraft Single-Star Signals AN-M43  
 to AN-M45 Series and AN-M43A1  
 to AN-M45A1 Series  
 Aircraft Signals AN-M53 to AN-M58  
 Series and AN-M53A1 to AN-M58A1  
 Series  
 Distress Signal AN-M75  
 Aircraft Emergency Identification Sig-  
 nals Mk 6 Mod 0 and Mk 7 Mod 0  
 Flash and Sound Signal M74  
 Ground Signals M17A1 to M22A1  
 Series and M17A1B2 to M22A1B2  
 Series  
 Illuminating Sheli M83  
 Navy Light Mk 1 and Mods  
 Pistol Rocket Signal Mk 1 and Mods  
 Pistol Rocket Signal (Smoke) Mk 2 and  
 Mods  
 Pistol Rocket Signal (Shower, Single  
 Burst) Mk 3 Mod 0

Red Star Parachute Distress Signal M131  
 Submarine Emergency Identification  
 Signal Mk 3 and Mods  
 Submarine Float Signals Mk 2 and Mods  
 Torpedo Float Signal Mk 21 Mod 1  
 Very Signal Light Mk 2 Mod 0  
 Mechanical Time Fuzes AN-M146A1,  
 AN-M147, and AN-M147A1

**MISCELLANEOUS EXPLOSIVE ITEMS.** The  
 following miscellaneous explosive items must  
 be dumped at sea and must not be destroyed  
 by burning:

Aircraft Engine Starter Cartridge,  
 Type II  
 Personnel Ejection Catapult Cartridges  
 M28A1 and M36A1  
 Bomb Ejector Cartridges Mk 1 and  
 Mods, and Mk 2 and Mods  
 Aircraft Canopy Remover Cartridges  
 M29A2 and M31A1  
 Signals (Underwater Sound) Mk 22 and  
 Mods  
 Mine-Sweeping Cutter Mk 13 Mod 0

**Items Which May Be Burned or Dumped.**

In the absence of instructions to the con-  
 trary, pyrotechnics and miscellaneous explo-  
 sive items not listed above may be either  
 burned or dumped in accordance with the  
 provisions of chapter 29 of OP 5, Volume 1,  
 or other current instructions from the Bu-  
 reau of Ordnance.



## Chapter 10

### SAFETY PRECAUTIONS

#### Safety Precautions for Pyrotechnics in General

1. Do not smoke or carry lighted cigars, cigarettes, or pipes in the vicinity of pyrotechnics.

2. Do not carry matches or spark-producing materials in or near stowage, or while handling or using pyrotechnics.

3. Handle flares and other pyrotechnics carefully.

4. Stow pyrotechnics in a dry, ventilated place.

5. Do not break the seal of pyrotechnic packings until just before the item is to be used.

6. Segregate pyrotechnics which have been exposed to moisture from other flammable or explosive material until an examination has proved that they are serviceable and safe.

7. Do not stow pyrotechnics where the direct rays of the sun can strike them; protect them against excessive temperatures. The temperature in stowage space should be below 100° F.

8. Aboard ship, stow smoke-producing pyrotechnics above deck, if possible, because it is difficult to combat fire in these materials when they are stowed where the smoke produced is not blown away.

9. Keep pyrotechnic ammunition clean; carefully remove foreign substances such as dirt, sand, mud, or grease before pyrotechnics are stowed or used; inspect periodically all pyrotechnics in stock, and segregate all defective units for disposal.

#### Safety Precautions for Flares

1. Securely fasten all flares carried aboard an aircraft.

2. Do not launch Aircraft Parachute Flare Mk 4 Mods 2, 3, 4, or 5 from bomb bays.

3. Do not release Parachute Flare Mk 4

Mods 2, 3, 4, and 5 over friendly territory at altitudes less than 1500 feet, except in extreme emergencies.

4. Do not launch Aircraft Parachute Flare Mk 5 Mod 8 over friendly territory.

5. Do not release Aircraft Flares Mk 5 Mods 3 to 7 from bomb bays, except in a flare carrier.

6. Do not launch Aircraft Parachute Flare Mk 8 from bomb bays.

7. Do not launch Aircraft Parachute Flare Mk 8 Mod 0 at speeds in excess of 150 knots.

8. Exercise extreme care in stowage, use, and handling flares.

9. Return to ammunition depots flares exposed to excessive moisture or mechanically damaged by rough handling, or dispose of such flares as directed by the Bureau of Ordnance.

10. Do not disassemble flares; do not remove parachutes or other components.

11. When High Altitude Parachute Flare Mk 20 Mod 0 is being used, a suitable barrier should be erected to protect firing personnel.

12. In case of misfire of a High Altitude Parachute Flare Mk 20 Mod 0 in a Projector Mk 13 Mod 0, a hangfire must be suspected, and it is necessary to wait at least 3 minutes before approaching the projector. Then the barrel may be removed from the base and cleaned.

13. Keep clear of Trip Parachute Flare M48 and Trip Flare M49 to avoid injury in case of accidental discharge. Each trip flare used in training will be fenced, or otherwise guarded, in a manner which will prevent personnel from approaching within 6 feet of the flare.

14. Do not approach within 6 feet of any installed flare.

15. Inspect fuzes carefully for rusted



safety pins. Fuzes containing defective safety pins should be destroyed by personnel specially trained in this type of work.

16. Plant Trip Parachute Flare M48 so that fragments formed by the earth cover or the flare case will not endanger friendly personnel and so that the illuminated area will not disclose defense positions.

17. Examine the housing of Trip Parachute Flare M48 before use to see that the joints are tight.

18. Do not plant Trip Parachute Flare M48 in wet locations; entrance of moisture will cause it to malfunction.

19. When using Trip Flare M49, remove the safety pin of the fuze only when the flare is in position and the wire has been connected and adjusted so that the trigger holds the safety lever in place. Do not remove the safety pin at any other time.

20. When Trip Flare M49 is being used as an illuminating grenade, the pin may be pulled only if the lever is restrained by the throwing hand and held securely until the flare leaves the hand.

21. Personnel setting Trip-Wire Flare Mk 1 Mod 0 should wear steel helmets. The head must be kept below the flare and as far away from it as possible.

22. Trip-Wire Flare Mk 1 Mod 0 should be mounted at least 125 yards in advance of a defense position to prevent self-illumination.

#### Safety Precautions for Markers

1. Check stowage areas containing water-activated markers periodically for the presence of gas from leaking markers.

2. When a cartridge-type marker misfires, make two more attempts to fire it, and then unload the cartridge only after waiting for at least 30 seconds because of the possibility of hangfire.

3. Secure markers stowed on an aircraft to prevent damage either to the markers or to the aircraft.

4. Do not remove the safety cotter pin from the firing mechanism unless the marker is held properly and is ready for launching.

5. Do not replace the safety cotter pin after it has been removed.

6. Do not remove the firing mechanism from a marker under any circumstances.

7. Stow depth charge markers separately from other pyrotechnics, if practicable.

8. Do not handle the marker or remove it from its container by grasping the tear strip pull ring.

9. Do not remove the tear strips of depth charge markers until just prior to use.

10. Make periodic inspections to insure that one or both tear strips have not been accidentally removed, and that no leaks exist in the seams of depth charge markers.

11. Do not remove pieces of adhesive tape covering the holes above the candles of Aircraft Float Light Mk 6 Mod 2.

12. Launch Aircraft Float Light Mk 6 Mod 2 or 3 immediately after the igniter pull ring has been pulled and ignition has been started.

13. Be sure, after removing the safety cotter pin of Depth Charge Marker Mk 1 Mods 2 and 3, to hold the release lever securely against the body of the marker until the marker is launched.

14. Do not stow depth charge markers in a compartment equipped with sprinklers and do not fight fires with water because the markers are ignited by chemical reactions between water and the chemicals within the markers.

#### Safety Precautions for Signals

1. When a cartridge-type signal misfires, make two more attempts to fire it, and then unload the cartridge only after waiting at least 30 seconds to eliminate the possibility of a hangfire.

2. Secure firmly signals stowed aboard an aircraft to prevent movement which might damage the signal or cause fouling of the controls of the aircraft.

3. Handle carefully signals containing primers to prevent a blow on the primer which might ignite the signal.

4. When signals with grenade-type firing mechanisms are being launched, hold the safety lever firmly against the body of the



signal while the safety cotter pin is removed and until the signal is launched. Do not remove the safety cotter pin until just before the signal is to be launched.

5. Do not replace the safety cotter pin on a grenade-type signal once it has been removed.

6. Do not remove firing mechanisms from aircraft signals.

7. Do not examine aircraft signals using grenade-type igniters while on an aircraft except for identification.

8. Do not look into the top of any signal of the hand-held type.

9. Launch aircraft signals in a safe direction to prevent accidents to friendly personnel and craft.

10. Never attempt to ignite both ends of Day and Night Distress Signal Mk 13 Mod 0 at the same time.

11. Do not handle Day and Night Distress Signal Mk 13 Mod 0 roughly.

12. Point the ignition end of Distress Signal AN-M75 up and away from the face.

13. Remember that the igniter holder of Distress Signal AN-M75 is thrown 10 feet after the primer ignites.

14. Do not attempt to investigate malfunctions of Distress Signal AN-M75.

15. Aircraft signal stars create a fire hazard when fired from the ground or over ground with inflammable terrain. This must be borne in mind if fired under these conditions.

16. Signals which function while being held in the hand should be held at arm's length to leeward at an angle of 30 degrees upward from horizontal to prevent burns caused by hot drippings or discharge.

17. Handle pistol-projected signals as small arms ammunition and never point them toward friendly personnel or craft.

18. When Flash and Sound Signal M74 is fired over personnel, the point of aim must not be less than 45 degrees above the horizontal to insure safety. At this angle of fire, the height of burst will be about 100 feet.

19. Personnel should not face the point of burst of Flash and Sound Signal M74.

20. Helmets must be worn by all personnel exposed to the detonation of Flash and Sound Signal M74.

21. Use only specified grenade launching cartridges with Ground Signals M17A1 to M22A1 Series and M17A1B2 to M22A1B2 Series.

22. Signals with cracked bodies, bent fins, deformed tail tubes, or with any other visual defect which might render them unserviceable must be discarded for disposal at a later time.

23. Do not watch the flight of these signals because of possible "blow-back" of the propelling charge.

24. Fire signals in a direction so that falling cases will not hit friendly personnel or installations.

25. All personnel firing these signals or within range of falling parts should wear steel helmets.

26. When using Illuminating Shell M83, remove the safety pin in the fuze only as the shell is loaded into the mortar and at no other time. Should the round misfire and the shell be removed from the mortar, replace the safety pin immediately.

27. Do not disturb the shear wire just beneath the safety pin of Illuminating Shell M83. If the wire is broken or missing, the round should be discarded.

28. Do not use more than the four propelling increments with Illuminating M83 under any circumstances.

29. The site at which Navy Lights Mk 1 Mods 0, 1, and 2 will be used must be carefully selected because burning particles that drop from the lighted candles may start a fire.

30. Hold up Navy Lights Mk 1 Mods 0, 1, and 2 at an angle of about 45 degrees and point to leeward during the burning.

31. Always point a pistol loaded with pistol rocket signals slightly outboard and away from surrounding personnel or vessels. This precaution should also be taken when loading new signals into the breech of the pistol.

32. Never disassemble faulty or misfired signals.



33. Use two hands when firing Red Star Parachute Distress Signal M131.

34. Be sure that Red Star Parachute Distress Signal M131 is not pointed toward personnel or flammable material.

35. If Red Star Parachute Distress Signal M131 is not fired, reset the safety bar, then replace and reseal the metal closing cover.

36. When using Submarine Emergency Identification Signals Mk 3 Mods 1, 2, and 3, and Submarine Float Signals Mk 2 Mods 0, 1, and 2, do not remove the safety pin from the signal until after the signal has been pushed beyond the detent and the breech door is about to be closed.

37. Keep body clear of the breech of the signal ejector.

38. When using Submarine Emergency Identification Signals Mk 3 Mods 1, 2, and 3, and Submarine Float Signals Mk 2 Mods 0, 1, and 2, inspect them frequently. Any corrosion of the safety mechanism is reason for disposal in accordance with current BuOrd directives.

39. When handling signals, do not point either end directly toward personnel.

#### Safety Precautions for Surface Projectors

1. When using Projector Mk 13 Mod 0, a suitable barrier should be erected to shield firing personnel.

2. Fasten the Projector Mk 13 Mod 0 securely to the deck or other support.

3. In case of a misfire, a hangfire must be suspected, and it is necessary to wait at least 3 minutes before approaching the Projector.

4. Pyrotechnic Pistol AN-M8, Rocket Signal Pistol Mk 1 Mod 0, and Very Signal Pistol Mk 5 Mod 0 are cocked at all times when the breech is closed. For this reason, a live signal must never be left in the pistol. Place cartridge in pistol only when immediate use is anticipated.

5. Never use pyrotechnic pistols for firing any ammunition except that especially designed for such use.

6. Never point a pyrotechnic pistol toward friendly personnel or craft while loading, firing, or unloading.

7. In case of a misfire of a cartridge-type pyrotechnic, make two more attempts to fire the pistol. Then the breech may be opened only after waiting at least 30 seconds.

#### Safety Precautions for Photoflash Bombs

1. Handle photoflash bombs with the same care as black powder since they explode with great violence and heat.

2. Do not hammer or cut bomb cases.

3. Do not disassemble bombs.

4. Do no work on bombs except unpacking, fuzing, and installing on aircraft.

5. Do not watch or look directly at the explosion of a photoflash bomb, even at a distance prescribed safe from flying fragments.

6. Do not jettison photoflash bombs over friendly territory.

7. Protect packages or boxes containing fuzes against shock.

8. Use detonator-safe fuzes on all photoflash bombs employed in carrier-based operations.

9. Treat as a dud any photoflash bomb that does not detonate on impact; destroy such a bomb in accordance with current instructions.

10. Make no modifications to the trail plate of Photoflash Bomb AN-M46 without first removing the trail plate from the bomb body. Machining or welding operations on the trail plate must comply with the safety requirements of OP 5.

11. If loose flashlight powder is present when the bomb is being fuzed, pick up the loose powder and dispose of the bomb in accordance with current regulations.

12. Dispose of damaged bombs or powder from damaged bombs in accordance with instructions contained in OP 5.

13. Store photoflash bombs and fuzes in a dry, well-ventilated place, out of the direct rays of the sun, and protected against excessive temperatures, as directed in OP 5.

14. Do not remove protective or safety devices from fuzes until just before use.

15. Do not attempt to disassemble any fuze.



### Safety Precautions for Aircraft Photoflash Cartridges

1. Do not remove the shunt cap from the cartridge until just prior to loading the cartridge in the ejector.
2. Do not attempt to disassemble or alter a cartridge in any way.

### Safety Precautions for Miscellaneous Explosive Items

1. Do not substitute aircraft jet engine starter cartridges for Bomb Ejection Cartridges Mk 1 Mod 2 or Mk 2 in the Douglas bomb ejector.
2. Be sure the O-ring gasket of Underwater Sound Signal Mk 22 Mods 0 and 1 is in place before the fuze is assembled to the signal tube.
3. When the fuze is being staked to the signal tube of Underwater Sound Signal Mk 22 Mods 0 and 1, be sure that the center punch is on the brass fuze body.
4. Replace any cap removed from Underwater Sound Signal Mk 22 Mods 0 and 1 by mistake. Take care not to break any of the rupture discs.
5. Learn in advance the operational requirements for Underwater Sound Signal Mk 22 Mods 0 and 1; check them again prior to each voyage.
6. Do not attempt to clean a Mine-Sweeping Cutter Mk 13 Mod 0 that has a bent trip wire.
7. Before installing the detonator unit, check the safety pin by removing it and reinserting it.
8. Do not insert the detonator unit of Mine-Sweeping Cutter Mk 13 Mod 0 until the cutter is ready to be mounted on the sweep wire.
9. With the detonator unit in place, do

not remove the safety pin until the cutter is ready to be lowered into the water.

10. Do not stop veering the sweep wire until the cutter is at least 3 feet below the surface of the water, or unless the cutter is still well above the surface.

11. When recovering gear, do not stop hauling in the sweep wire while the cutter is less than 3 feet below the surface, or until the cutter is well above the surface.

12. Insert the safety pin as soon as the cutter is within reach.

13. If the trip wire is bent appreciably, insert the safety pin into the safety-pin hole, if it can be inserted. If the safety pin cannot be inserted, follow the instructions for disposing of the cutter.

14. When the safety pin has been inserted, remove the detonator unit as soon as the cutter is on deck.

15. Do not clean the cutter before removing the detonator unit and wiring the safety pin in place.

16. After cleaning, make sure that all water has drained from the plunger recess by holding the cutter with the jaws up.

17. If there is any reason to believe that water may have accumulated in the plunger cup while the cutter is on deck, allow the water to drain out before inserting the detonator unit.

18. Do not attempt to repair or disassemble either the cutter itself or the detonator unit.

19. When not submerged, protect the cutter and the detonator unit from prolonged exposure to the direct rays of the sun or abnormal temperatures.

20. Do not drop or handle the cutter roughly.



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OP 2213

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PYROTECHNICS AND MISCELLANEOUS EXPLOSIVE ITEMS